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A CLINICAL STUDY OF SOME COMMON ANATOMICAL ABNORMALITIES OF THE COLON
II. THE LOW CECUM *

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DESPITE the fact that low placement of the cecum is the most common anomaly of the colon, the clinical significance of this condition is probably by no means well known to the practising physician. As with the redundant colon, we owe what knowledge we possess to anatomists and surgeons, rather than to clinicians. To cite but American authors, we have excellent anatomical studies by such men as Harvey,[1] Smith,[2] and Davis.[3] The roentgen study by Payne and Trahar[4] likewise deserves special mention. The original outburst of Continental literature on "cecum mobile" was beautifully summarized by Sailer[5] in 1912 with the addition of a few personal cases. The surgical aspects of the subject have in the past centered about the unwarranted and totally inadequate concept of chronic or pseudo-appendicitis. Fortunately, we are now rapidly emerging from this delusion through the well-considered contributions of such American surgeons as Jackson,[6] Coffey,[7, 8] Connell,[9, 10] and Gibson.[11] However the earlier work of Wilms[12] in Germany, the stimulating, though by no means universally accepted hypotheses of Lane,[13] and Jordan[14] in England, and the very recent book on "Pseudo-appendicitis" by the Frenchmen, DeMartel and Antoine,[15] should not fail of mention in even the most sketchy outline of the literature on this subject.

Anatomical Considerations. As a result of the embryologic process known as "descent," the cecum, when its position is normal, comes to rest in the right iliac fossa. If the process of descent continues unabated, the cecum progresses into the pelvis. This condition is spoken of as "hyperdescent," and the cecum may properly be called a "low cecum." Normally the cecum is unattached, whereas the ascending colon is fixed to the posterior abdominal wall. When the ascending colon is provided with a mesentery, the mobility of the cecum is correspondingly increased (cecum mobile). On the other hand, when the normal fixation of the ascending colon is continued downward, the cecum becomes fixed in turn to the posterior abdominal wall. If, in addition there is hyperdescent, we may speak of a "low, fixed cecum" (Fig. 1).

Materials, Methods, Measurements, Criteria. This study is based on an unselected series of 100 cases. These were encountered in 554 consecutive private patients complaining of various gastrointestinal symptoms, who were studied roentgenologically by the barium meal

* The first article of this series, "A Clinical Study of Some Common Anatomical Abnormalities of the Colon. I. The Redundant Colon," appeared in THE AMERICAN JOURNAL OF ROENTGENOLOGY AND RADIUM THERAPY, 1924, xii, 414–430. Read before the Passaic County Medical Society, Paterson, N. J., April 9, 1925, and before the Section of Medicine, New York Academy of Medicine, April 21, 1925.

method. Of these, 202 had their colons further investigated by means of the opaque enema. These 554 patients, in turn, constituted a part of a total series of 1229 cases, practically every one of which had a routine gastrointestinal study including history, physical examination, and test meal.

Many of the cases have been under observation for two or three years, and some date back as far as seven or eight years.

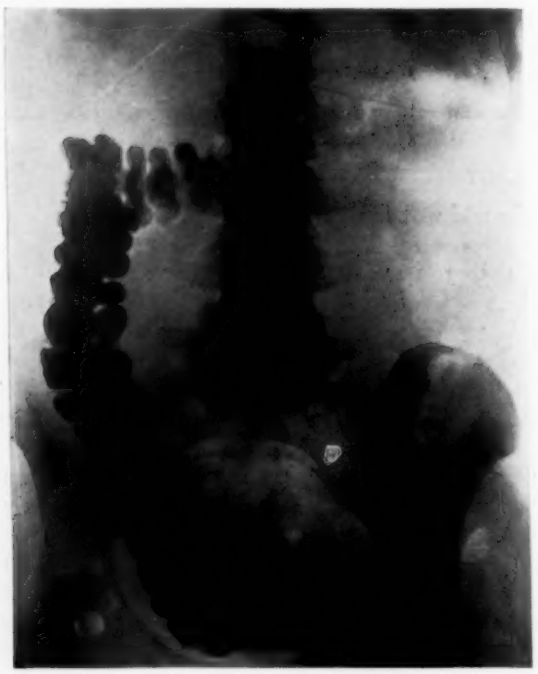

FIG. 1. Low fixed cecum. Appearance 9 hours after barium meal.

FIG. 2. Low cecum. Opaque enema.

The position of the cecum was determined by the roentgen method. For this purpose the barium meal was generally found more satisfactory than the opaque enema (Figs. 2, 3, and 5), the best time for observation of the low cecum being nine hours after the meal was ingested.

A cecum was called "low" when it reached down to or below a level corresponding to half way between the brim of the pelvis and the pubic symphysis, as seen in the usual dorsoventral film taken prone—in short, when it has prolapsed half way or more into the pelvis. This was of course an arbitrary standard, but it was felt to be a safe one because it would include only typical examples, and be free from unavoidable errors due to slight variations in technique.

The movable cecum was lowest when most heavily filled, generally six to nine hours after the barium meal. From that point it rose progressively as it emptied, often reaching a normal position. On the other hand, a fixed cecum remained *in situ*, no matter how heavy or light the filling, or under what conditions the observations were made. In the present series of 100 low ceca, exactly half the cases were fixed and half were movable.

As might be expected, the low cecum was also found to be a long cecum; or perhaps more accurately stated, it formed a part of a long ceco-colon. In order to obtain comparative meaurements 459 normal ceco-colons were examined. These were found to have an average length of 7 inches (about 18 cm.). The average length of the ceco-colons in the 100 low cecum cases was found to be 9⅓ inches (about 23.5 cm.). The longest (of which there were 4 exam-

FIG. 3. Cecum mobile showing ceco-colon folded over and turned in (A). Opaque enema.

FIG. 4. Low fixed cecum, showing cecal residue (A) 48 hours after barium meal.

FIG. 5. High cecum ("non-descent"), showing high "insertion" of terminal ileum (A). Opaque enema.

ples) were 13 inches (33 cm.); the shortest was 6 inches (15.2 cm.).

Incidence. The incidence of low cecum was found to be 18.1 per cent (100 cases out of 554). The relation of low ceca to normal and high ceca can be seen in Table 1.

TABLE 1
INCIDENCE OF THE COMMON ANOMALIES OF THE COLON (ROENTGEN DATA)

	Cases	Per Cent
Normal ceca	437	78.8
Low ceca	100	18.0
High ceca	17	3.0
Total cases	554	100.0
Incidence of redundant colon in above series	78	14.0

The incidence of this condition as reported in the literature averages about 15 per cent (Harvey, Smith, and Davis). Practically all the studies are from autopsy material; a few of the figures are based on operative findings; there are apparently no detailed roentgen statistics available.

It will be observed that the incidence of low cecum (18 per cent) is somewhat higher than that of redundant colon (14 per cent, revised figures). A review of the 62 redundant colon cases shows that a low cecum was present as an associated condition 6 times (instead of twice as stated by error in the original publication), an incidence of 9.6 per cent. In the present series of 100 low ceca, redundant colons were encountered 10 times. In other words, the association of both conditions simultaneously is approximately one in ten.

Low cecum, like redundant colon, is probably a hereditary and a familial condition, though, here too, my data are insufficient for positive statement.

As regards sex, the low cecum is by far a peculiarity of the female, 79 per cent of my cases having occurred in women. These figures may be compared with those of Harvey (62 per cent females) and with those of Smith (66 per cent females). It will be noted that the sex incidence is the reverse of that with redundant colon (62 per cent males).

The incidence in regard to habitus is also exactly the reverse of that with redundant colon. Whereas in the latter condition about 55 per cent of the patients were sthenics (stocky), and only 30 per cent asthenics, the low cecum occurred with a frequency of 54 per cent in asthenics and only 7 per cent in sthenics. It may be thought, at first, that low cecum is synonymous with the asthenic habitus, or, in other words, that it represents a local condition of ptosis. That this is not so is borne out by the fact that the relationship is not reciprocal. In 143 asthenics (ptotics) who were roentgenographed, low ceca were found in only 37 per cent, whereas practically all showed ptosis of the stomach and transverse colon. Moreover, as Harvey points out, over three-quarters of his cases (just half of mine) had their normal support from the attachment of the colon to the abdominal wall, and were therefore examples of a true overgrowth of the cecum.

Further details concerning the relation of low cecum to body habitus will be found in Table 11.

TABLE 11
RELATION OF LOW CECUM AND REDUNDANT COLON TO BODY HABITUS

	Asthenics	Intermediates	Sthenics
1229 unselected cases (general incidence)	263 or 21.4 per cent	777 or 63.2 per cent	189 or 15.3 per cent
100 low ceca	54 or 54.0 per cent	39 or 39.0 per cent	7 or 7.0 per cent
62 redundant colons	19 or 30.0 per cent	9 or 14.4 per cent	34 or 54.8 per cent

In 143 roentgen rayed asthenics	Low ceca occurred in	54 or 37.7 per cent
	Normal ceca occurred in	89 or 62.2 per cent
	High ceca occurred in	1 or .7 per cent

Symptoms. The symptoms associated with low cecum are either systemic, being strikingly those of so-called "autointoxication" namely, nausea, vomiting, headache and depression; or they are local, giving rise to colicky pains in the right lower quadrant. However, it would be an error to believe that such symptoms are present all the time, or even a great part of the time. As with all congenital anomalies—a point already emphasized in the first paper of this series—the condition implies merely a definite predisposition to these forms of malfunction. This predisposition is increased notably by strains, be they mental, physical, traumatic or emotional; and by fatigue or exhaustion.

Vomiting. A tendency to vomit is by far the outstanding clinical manifestation of the low cecum. As far as I know this association has not previously been emphasized in the literature. By the expression "tendency to vomit" I mean that the individuals in question constitute the group of "easy vomiters" of ordinary experience. Either they give a history of frequent vomiting bouts from relatively slight digestive upsets, or they have more well-defined attacks with sick headaches (bilious attacks), occurring in women more often during the menstrual epoch. In other cases there is a history of car sickness or train sickness and possibly, though I have not sufficient evidence, increased tendency to seasickness. In less well-marked cases there may be frequent attacks of nausea without vomiting, or there may be regurgitation. In one case in addition to easy vomiting, there was selective merycism. As with the habitual constipation mentioned in the description of the redundant colon, it should be kept in mind that the vomiting may be considered by the patient so much a part of her "normal" make-up as not to be complained of in the history. This symptom must therefore be specifically asked for by the physician.

The incidence of vomiting in my series of 100 low ceca was 59 per cent. If to those who vomit are added those who have only nausea or regurgitation, the proportion grows to 74 per cent. This should be contrasted with a general incidence of vomiting—as obtained by reviewing an unselected series of 1229 gastrointestinal cases—of 19 per cent. That the relation of vomiting to low cecum is a real correlation between these two conditions would appear from the following considerations (Table III): 1. There is a direct relationship between the tendency to vomit and the length of the ceco-colon, inasmuch as the frequency in low ceca is five times that in high ceca, and three times that in normal ceca. 2. Almost half of all vomiters have low ceca (44.3 per cent). These last figures were obtained by roentgenographing an unselected series of 133 vomiters from all causes. Even pyloric obstruction cases were included, so that an error, if present, would appear in the direction of under rather than of overstatement. 3. The vomiting is not due to the asthenic habitus, because even in asthenic vomiters it is generally only those with low ceca who vomit (4 vomiters with low ceca to one with normal or high cecum).

TABLE III

RELATION OF VOMITING TO LOW CECUM AND OTHER CONGENITAL ANOMALIES OF THE COLON

Incidence of vomiting	Cases	Per Cent
1229 unselected cases (general incidence)	236	19.3
17 high ceca	2	11.7
437 normal ceca	70	16.0
62 redundant colons	14	22.5
264 asthenics	62	23.5
100 LOW CECA	59	59.0
In 133 roentgen-rayed vomiters		
Normal ceca occurred	72	54.0
LOW CECA occurred	59	44.3
High ceca occurred	2	1.5
In 143 roentgen-rayed asthenics vomiting occurred		
In those with normal ceca	13	14.6
In those with LOW CECA	31	57.4

Headaches. Headaches, like nausea and vomiting, may be regarded as toxic or reflex manifestations. Except that the incidence of headaches in my series was slightly lower than that of vomiting, namely 48 per cent, the correlation between low cecum and headaches is seen to develop in exactly the same manner as between low cecum and vomiting. There

is the same increase in incidence with increase in length of the ceco-colon and the percentage of low ceca in headache cases is almost precisely the same as in an unselected series of vomiters, namely 44 per cent in each (see Table IV).

TABLE IV

RELATION OF HEADACHES TO LOW CECA AND OTHER CONGENITAL ANOMALIES OF THE COLON

Incidence of headaches	Cases	Per Cent
1229 unselected cases (general incidence)	214	17.5
17 high ceca	2	11.7
437 normal ceca	63	14.4
62 redundant colons	11	17.7
264 asthenics	59	22.3
100 LOW CECA	48	48.9
In 107 roentgen rayed headache cases		
Low ceca occurred	47	44.8
Normal ceca occurred	59	55.1

TABLE V

RELATION OF CONSTIPATION TO LOW CECA AND OTHER CONGENITAL ANOMALIES OF THE COLON

Incidence of constipation	Cases	Per Cent
1229 unselected cases (general incidence)	549	44.6
264 asthenics	129	48.8
437 normal ceca	216	49.4
17 high ceca	10	58.8
100 LOW CECA	61	61.0
62 redundant colons	48	77.4

Constipation (*Table* V). Although the incidence of constipation is apparently high in low cecum cases (61 per cent), it is hardly such a characteristic feature as are many of the other symptoms associated with this condition. Several reasons seem to explain this apparent paradox. In the first place, there is no such impressive increase in the incidence of constipation with increased length of the ceco-colon as we have been meeting heretofore. In the second place, the degree of constipation is nowhere so severe here as it is in redundant colon with its long intervals between stools. Finally, in many cases of low cecum the constipation is masked entirely—that is, the patient is unaware that colonic evacuation is impaired because he has daily bowel movements, and it is left for the roentgen examination to reveal both the fact and the degree of stasis.

It is customary in discussing "cecum mobile," to assume that the probable cause of symptoms resides in the difficulty of evacuating against gravity a long, mobile and possibly kinked ceco-colon. It is also customary to place the normal emptying time of the cecum at fifteen hours (De-Martel and Antoine) to twenty-four hours (Hurst).[16] However, in estimating the ability of the ceco-colon to empty itself, one must not overlook the important fact that distal colon stasis will automatically produce ceco-colic (proximal colon) stasis. In this study a "pure" cecal stasis (Fig. 4) was encountered in about one-third of the cases of low cecum. It was impossible however to prove that there was any causal relation between cecal stasis and the usual symptoms associated with low cecum.

Pain. As has already been mentioned, this symptom has practically dominated all previous discussions of this subject. In the present series abdominal pain occurred 56 times (56 per cent), an incidence almost as great as with redundant colon (58 per cent), and considerably greater than is generally met with in gastro-intestinal patients (501 times in 1229 unselected cases or 40.7 per cent). Unlike the case in the redundant colon, where the pain was often localized in the left lower quadrant, the pain in low cecum patients was almost constantly present in the right lower quadrant. It is because of this localization that the diagnosis of "chronic appendicitis" is so freely made. The pain is either dull, dragging in nature and constant in occurrence, or else comes in attacks of colic, sometimes, though by no means always, associated with vomiting. Although tenderness over the distended or gurgling cecum is commonly present, rigidity and fever do not enter into the clinical picture. The painful colics can perhaps best be explained by attempts of an overloaded cecum to empty itself with or without the added presence of a kink or partial twist or volvulus.

Appendectomy. As a result of the painful phenomena above described, the bearers of low ceca are very commonly subjected to operation for removal of the appendix. It need hardly be added that such interventions are almost invariably unsuccessful in affording relief from symptoms. Whereas the general incidence of appendectomies in gastrointestinal cases is 12 per cent, the frequency of this operation increases sharply with the length of the ceco-colon (see Table VI). Thus in patients with high ceca, the incidence is 10 per cent, while in those with low ceca it is almost double that number (21 per cent). In other words, more than one-fifth of this series of 100 cases have had previous appendectomies without benefiting their underlying condition. At most, the pains were improved or relieved in but one or two instances. Operation was probably offered at one time or another to a much larger number. One patient told me that she escaped this procedure on at least half a dozen occasions because she happened to have a weak heart (mitral stenosis). Fortunately, we are now just beginning to learn and to believe that pain in the right lower quadrant may mean something else than "chronic appendicitis."

TABLE VI

RELATION OF APPENDECTOMY TO LOW CECUM AND OTHER CONGENITAL ANOMALIES OF THE COLON

Incidence of Appendectomy	Cases	Per Cent
1229 unselected cases (general incidence)	153	12.4
264 asthenics	27	10.2
17 high ceca	2	11.7
437 normal ceca	59	13.0
62 redundant colons	10	16.1
100 LOW CECA	21	21.0

Diagnosis. The presence of a low cecum may be suspected from the history and from physical examination. The history reveals frequent vomiting, regurgitation and headaches; the physical examination shows an asthenic subject, usually a woman, and an easily palpable, erect, gurgling and frequently tender cecum, which may or may not be freely movable. The positive diagnosis is made by roentgen examination. If the cecum is fixed as well as low, any procedure that visualizes the cecum will reveal the condition. In other words, a barium meal observed at any time the cecum is filled, or a barium enema alone, will suffice for the purpose. If, however, the cecum is low and movable, the condition can best be revealed by observation when the cecum is most heavily loaded. This period is generally reached nine hours after the barium meal is administered. In many cases manipulation under roentgenoscopic control will give information as to mobility, but often even a freely movable (nonfixed) cecum, low in the pelvis, cannot be readily gotten at by palpation. Therefore a complete gastrointestinal study, consisting of barium meal and barium enema under both roentgenographic and roentgenoscopic control is the ideal method of investigation.

Significance. From studies such as the above, it seems more and more likely that we are now in a position to formulate the following tentative proposition: Congenital anomalies of the distal colon, as exemplified by redundancy, are chiefly associated with severe constipation, but are not especially likely to give rise to symptoms of so-called "auto-intoxication." On the other hand, congenital anomalies of the proximal colon, although they may also be associated with constipation, seem to be quite characteristically allied to general systemic upsets (so-called "auto-intoxication"), such as vomiting and headaches. What the exact mechanism of this association may be is still a matter of doubt. Thus, I have so far been unable to prove—by the statistical method—that either cecal or ileac stasis (Figs. 6 and 7) has any causative influence whatever on the production of the symptoms in cases of low cecum. Moreover, it must always be kept in mind that the colonic anomaly may act in some way only as a predisposing factor, rather than as the primary cause of the symptoms in question. However, studies along these lines are still in progress, and will form the basis of another paper. Obviously much more remains to be done before we can hope to clear up the many problems that press for solution.

Therapy. The treatment of patients with low cecum should embrace the following items: (1) Rest, physical, nervous and emotional; (2) abdominal support to restore normal intra-abdominal pressure and overcome the associated ptosis; (3) restoration of colon function. This means the cure of constipation and implies the absolute elimination of cathartics and enemas, and particularly of irritating irrigations. On the other hand, small rectal oil injections continued over long periods and oil or agar-oil mixtures by mouth, give good results in these cases; (4) fattening cure, and (5) antispasmodics and general sedatives such as repeated, small doses of chloral or bromides or codeine.

FIG. 6. Ileac stasis (arrow) in a case of low cecum. Appearance 9 hours after barium meal.

FIG. 7. Ileac stasis (arrow) in a case of normal cecum. Appearance 9 hours after barium meal.

A few words as to surgery. Removal of the appendix is futile. More radical operations devised to improve the position of the cecum and to fix it if movable, though theoretically less objectionable are probably unnecessary, except in rare cases of actual volvulus of the cecum. Excision of the proximal colon or short-circuiting operations are associated with grave mortality risks, are illogical, and are decidedly to be avoided.

CONCLUSIONS

1. Low cecum is a common congenital anomaly of the colon occurring in 18 per cent of all patients.

2. This anomaly occurs more often in persons of the asthenic habitus and is more common in women.

3. Patients with low ceca show a marked tendency to present certain reflex or toxic symptoms '(so-called auto-intoxication). Most of them vomit (59 per cent), and many suffer from headaches (48 per cent). They constitute the "easy vomiters" or "neurotic vomiters" of everyday life.

4. The exact nature of this association between low cecum and the symptoms described is not yet clear.

5. Attention is thus invited to the colon as a factor in vomiting—a hitherto insufficiently emphasized concept.

6. The presence of low cecum can be diagnosed positively only by roentgen examination.

7. Appendectomy is generally performed, but is seldom of benefit in cases of low cecum.

8. Appropriate conservative medical treatment gives relief or cure in the great majority of cases.

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THE ROENTGEN ASPECT OF EMPYEMA IN CHILDREN

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EMPYEMA is generally considered to be a serious disease, attended by many pitfalls in diagnosis and treatment. This is particularly so with children in whom the disease often becomes exceedingly difficult to diagnose, due to the insidious nature of the onset and the confusing physical signs frequently seen. There are cases on record where a child has had a purulent pleurisy for months or even years without the disease being suspected. As with the clinical picture, the roentgen findings frequently prove puzzling.

The literature is exceedingly scanty, and in most cases the authors refer to the subject only casually. It is therefore our endeavor to emphasize points which we have found useful in diagnosis. This paper is based on a study of roentgenograms and clinical aspects of 225 cases of empyema and 100 cases of nonpurulent effusion covering a period of thirteen years.

We shall not attempt to describe the pathogenesis of the various forms of empyema but will review a few of the more important anatomical features as seen in the thorax of a child.

The first and most obvious point is the size of the chest which permits a relatively small accumulation of pus. It is, therefore, comparatively rare to find a shadow of such density that the rib outlines are lost. For the same reason the costo-phrenic angles can often be outlined even though there is a relatively large effusion present.

The chest and the thoracic contents in a child are much more mobile than those of an adult. A small collection of pus will exert enough pressure to displace the mediastinal contents. Likewise we encounter asymmetry of the chest and scoliosis of the thoracic spine. This is entirely distinct from the later permanent changes due to chronic fibrosis within the pleural cavity. We have found this relatively early splinting of the chest to be of great value in diagnosis.

Pathological processes take place very rapidly in a child's chest. The entire picture may change over night. If doubtful one should not hesitate to ask for frequent examinations. The rapidity of change may have some diagnostic value, as shown later.

The technique employed is important. Except with a few of the older children, stereoscopic films are not attempted. In every case of suspected empyema postero-

anterior films in the upright and prone positions are taken, using double intensifying screens. The spark gap and milliamperage are varied according to the size of the patient, and his ability to cooperate. At times lateral films are taken but we find them of little value. With older children the roentgenoscope may yield valuable information. When taking the film the child should be instructed to sit as straight as possible. This tends to eliminate erroneous deductions which might ensue were the child allowed to slump from laziness or fatigue.

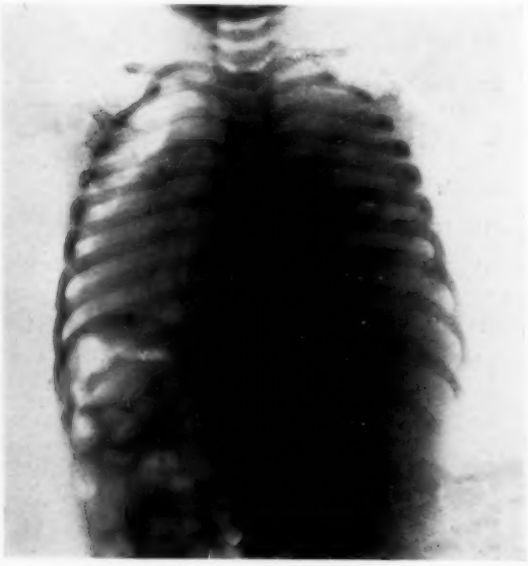

FIG. 1. Shows large effusion yet costo-phrenic angle remains visible. No definite fluid line. Marked displacement of heart away from affected side.

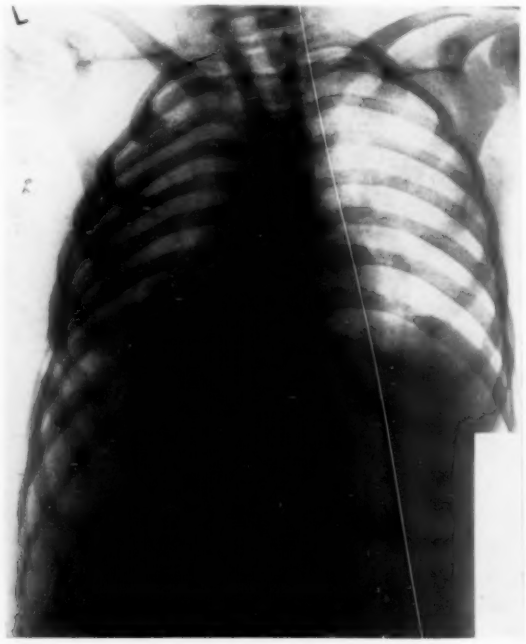

FIG. 2. Shows very marked scoliosis away from affected side.

Our series showed an equal involvement of both sexes. Most studies have shown a predominance of males. The age also is of no practical assistance. The disease, however, is rare under one year of age, and is found most frequently from three to four years.

The left side is most frequently affected but both may be involved in a small percentage of cases. Our statistics showed 3 per cent but others have had as high as 8 per cent with a double empyema. The involvement as a rule is not simultaneous and warrants a bad prognosis.

As mentioned before, asymmetry of the chest and scoliosis of the thoracic spine must be carefully looked for. A large number of the children showed scoliosis, 78 per cent in all. By asymmetry we mean a narrowing of the intercostal spaces on the affected side. Most of the cases not presenting the above signs had a large collection of pus with considerable displacement of the heart and were not doubtful.

With an adult one of the diagnostic signs of fluid is the obliteration of the costo-phrenic angle. This cardinal point does not hold true with children. The costo-phrenic sinus was visible in 28 per cent of the series.

There is apparently no site of predilection. The effusions are frequently widespread, possibly more so than seen in later life, but encapsulation along the lateral wall is fairly common. An interlobar empyema is relatively rarely encountered. There is no particular characteristic of the fluid line.

An attempt was made to establish a relationship between the character of the shadow and the organism isolated, but without success. In general, the pneumococcus exudate casts a comparatively

heavy shadow, but at times other organisms do likewise. The problem becomes complicated by the presence of possible underlying pulmonary pathology, so no definite conclusions could be reached.

Displacement of the heart was carefully searched for and found in 41 per cent of the series. If any doubt exists it may be necessary to use a film of a normal chest of the same age for comparison. It is evident, then, that as much attention must be paid to ensure a correct position as when taking a heart film.

The effect on the shadow of a change of position is considered important. One quarter of our cases had a definite change in shape and density of the shadow when the prone position was assumed. As would be expected, the change is often greater where there is a small amount of fluid present. (This is fortunate, for this type of case is most difficult to diagnose.)

The most important condition to be differentiated from empyema is consolidation. At times consolidation and fluid are seen simultaneously. The overlying fluid may mask the pulmonary pathology. Consolidation by itself does not show asymmetry of the chest or scoliosis of the thoracic spine. The heart and mediastinal contents are not displaced away from the affected side. There is no fluid line along the lateral wall, and the shadow is somewhat denser at the midde, decreasing as the periphery is reached. The shadow may have a mottled appearance. It is not apt to be so extensive and is frequently bounded by the limits of a lobe. In a very young child a shadow of any extent is quite likely to be fluid.

A radical over-night change in the character of the density is more suggestive of consolidation. With pneumonia there is no change in position of the shadow when the patient is moved from the upright to the prone position. Our difficulty is often greatly increased by the fact that in certain empyemas, notably those caused by the *Streptococcus hemolyticus*, the effusion may come simultaneously with or possibly before the consolidation. In these cases a delay of a few days does no great harm.

Thickened pleura can be recognized, as a rule, because there is no change of shadow as the position varies. If there is any displacement of the heart it is toward the involved side.

At times a pericardial effusion may cast a shadow bearing a striking resemblance to empyema or vice versa. Two such cases were seen by one of us recently. Due to superimposition upon the cardiac shadow, an empyema located near the mediastinum, may give the heart a water bottle shape. In most cases the absence of pulsation and the shape of the shadow will rule out pericardial fluid. If possible careful roentgenoscopic examination should be made in all atypical cases of empyema.

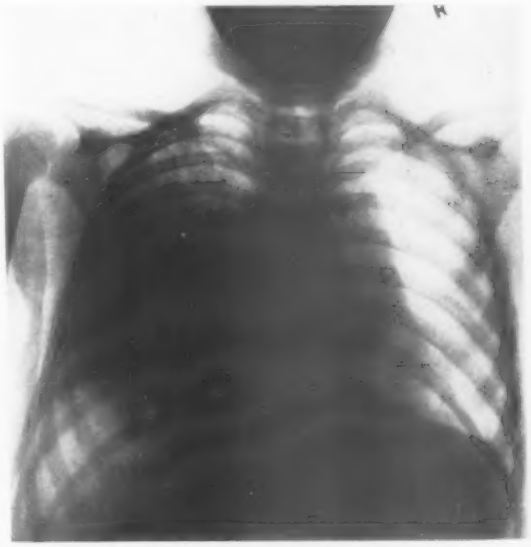

FIG. 3. Extensive left-sided effusion, causing such marked displacement that the heart shadow takes on appearance of a pericardial effusion.

Bronchiectasis can cause confusion only in the acute stages, when it resembles pneumonia.

In massive collapse of the lung the heart is displaced to the affected side and there is greater density of the shadow.

The purely surgical aspects and the mortality rate are discussed at length by Cutler and Ladd, 60 per cent of whose cases are included in our series. From the roentgenologist's point of view the most important question is to determine the adequacy of the drainage instituted by the surgeon. In children there is more difficulty in keeping drainage tubes in their proper place, and if intercostal drainage is used

the tube may become pinched, causing inefficient evacuation of the pus.

If a sinus persists after a long interval and there is reason to think that multiple pockets have formed, injections of Beck's paste are sometimes made. There is nothing about this procedure that differs from the same practice in adults.

Osteomyelitis of the ribs is occasionally seen in postoperative cases, but is not nearly so common as supposed. Definitely necrosed bone was removed from two children, and a slight involvement was noted in two others of our series. The rareness of this complication is remarkable when one considers the great liability which young people have to purulent infections of the bone.

Comparatively few children of our series have had films taken for the purpose of checking up end results, so no definite conclusions can be reached. The few cases which we did so examine showed a remarkable return to normal. Thoracoplasty causes great deformity which is permanent.

SUMMARY

(1) The roentgen diagnosis of empyema in children offers certain difficulties.

(2) Useful diagnostic points are given.

(3) The necessity for careful technique is explained.

(4) The importance of re-examination is emphasized.

(5) Postoperative films are very valuable and should be taken at intervals to check progress of lesions.

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HEALED MILIARY TUBERCULOSIS OF THE LUNG

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FROM the days of Bayle, who first applied the term "miliary" to a disseminated seeding of the lungs with minute tuberculous lesions, this form of the disease has been considered uniformly fatal by the profession at large. Indeed the skepticism of competent authorities until very recent years has thus been expressed by Fowler:[1] "It has been suggested that miliary tuberculosis of the lungs may undergo arrest, but if this ever happens after extensive infiltration has occurred, it must be an event of extremely rare occurrence. In the course of a considerable pathological experience the writer has never observed appearances indicating such a condition, and the recorded cases are far from conclusive. The disease generally ends fatally in from ten days to about three weeks, but life may be prolonged for three months, or even for a longer period."

On the other hand, the clinical manifestations and course of any given infectious process are the net result of the virulence and dose of the infecting agent and the resistance of the attacked individual. Granted sufficient resistance to meet or to overwhelm the sudden onslaught of a blood-borne tuberculous invasion, it is not inconceivable that arrest of even a miliary tuberculosis may result. The experimental studies of Gardner[2] have conclusively proven the occurrence of resolution in pulmonary tuberculosis even after caseation has occurred. One determining element in these results was the low virulence of the organism inducing the lesions—a circumstance which might readily explain

recovery in man after extensive tuberculous invasion of the lungs. Under certain circumstances the dosage of the tubercle bacilli entering the blood stream may be divided, and a higher resistance to the successive crops of tubercles may determine the arrest of the process. Thus, theoretically and experimentally there is reason to anticipate arrest of an apparently overwhelming tuberculization under favorable circumstances.

Convincing proof of this unusual result was lacking until Opie and Anderson[3] in 1920 reported their necropsy findings on 86 adults dying from causes other than pulmonary tuberculosis. In this survey the roentgen ray was utilized to determine the occurrence of calcified areas in the lungs. Only 7 of this series failed to show calcified nodules, which were interpreted as evidence of healed tuberculosis. They arbitrarily divided their cases into four groups. For the present purposes Group 4 alone concerns us: "In a few instances there is more widespread calcified tuberculosis. The lungs are thickly and often almost uniformly studded with nodules, often 0.5 cm. in diameter. These nodules are represented by conspicuous spots in the *x*-ray plate; but on superficial examination of the lungs themselves their great abundance might be overlooked, for only an occasional calcified nodule may be seen upon cut section or below the pleural surface. There may be extensive lesions at the hilum of the lung or about the trachea . . . " Three of their 79 cases showing calcified tuberculosis were grouped under the above description. They concluded that "at some time preceding death the individual has suffered with a severe widespread tuberculosis of the lungs, which has not caused death but has persisted so long that caseous material has been completely replaced by calcium deposit. It may be assumed that the lesion is healed since all evidence of activity has disappeared."

The clinical confirmation of these necropsy observations by roentgenologic studies of the living has not been lacking, although the reported instances of its occurrence must underrate the actual incidence. In 1914, Northrup[4] cited the case of a child who left the hospital with the typical roentgenologic picture of miliary tuberculosis of the lung, and urged that the more general use of this aid in diagnosis would add many similar cases to the literature. This opinion was supported in 1916 by von Muralt,[5] who pointed out the value of the roentgenogram in the diagnosis of miliary tuberculosis of the lung. Evidence was likewise adduced for the occasional chronic course of this condition and for its healing in rare instances. In 1922, Lorey[6] reported an interesting case of miliary tuberculosis presenting a classical roentgenologic appearance, which entirely cleared up in about eighteen months. In 1922, Bierman[7] reported 5 cases of healed miliary tuberculosis of the lungs as determined by roentgenologic study, but unfortunately the reproductions of his plates are indistinct, and only one of his cases falls clearly into the group under discussion. His major contention of the occurrence of a miliary tuberculosis of the lungs of low or sublethal virulence is, however, well taken. Stivelman and Hennell[8] demonstrated resolution in 2 cases of miliary tuberculosis of the lung by serial roentgenologic studies. In another case with a history of extensive tuberculosis in adolescence the following note was made: "Here the calcification of a widespread lesion has taken place to an

FIG. 1.

extent only rarely observed, with the result that the patient has practically been cured of his tuberculosis, judging from the present signs and symptoms." Dunham and Skavlem[9] reported 2 cases of healed miliary tuberculosis, diagnosed by roentgenograms and confirmed by necropsy. They intimated its relatively common occurrence. Baer,[10] in 1924, added another example of recovery from miliary tuberculosis of the lungs showing at roentgen examination extensive calcified nodules throughout the lung substance. In the same year Blaine[11] reported 3 cases with similar roentgen findings.

The apparent rarity of the condition leads to the presentation of the following case, which, with certain obvious reservations, is felt to fulfill the criteria imposed by Opie and Anderson.[3]

C. F. A white male, aged thirty-nine, a painter by occupation, was admitted to the State of Wisconsin General Hospital on March 31, 1925, complaining of weakness. This condition dated back six years when he acquired syphilis. From the period of the secondary eruption he received intravenous therapy and the Wassermann reaction became negative. A period of freedom from symptoms succeeded for eighteen months. Thereafter weakness and generalized pains ensued; but these symptoms together with gastric distress and vomiting disappeared on the institution of antiluetic treatment. The Wassermann reaction, which had become positive, again became negative. A recurrence of symptoms after two years was attended by a reappearance of a positive Wassermann reaction. Treatment was renewed.

Indefinite gastric symptoms, coupled with loss of weight and strength, led to his admittance to a tuberculosis sanatorium in January, 1925. Slight cough had developed at this time, but the sputum examinations were repeatedly negative for tubercle bacilli. Iodides and mercury were administered while in this institution.

The past medical history is possibly significant in the occurrence of a chronic cough in childhood, lead poisoning 1916, influenza in 1919, and pleurisy in 1919.

The patient has been a painter for twenty years. He has always been a resident of the Middle West. The family history is irrelevant.

The physical examination showed no suggestive findings except the coronal scar of a primary lesion. Certain equivocal findings at the apices led to a stereoscopic study of the chest with the following result: Trachea is to the right of midline. There is slight prominence of the arch of the aorta. The heart is within normal range as to size and contour. The entire lung fields show diffuse calcified areas, nodular in form, from 1 to 3 mm. in diameter. The basal fields are more markedly stippled than are the apices. These calcified nodules extend peripherally beyond the bronchial lymph nodes, but in many locations occupy sites corresponding to the smaller bronchial bifurcations. The hilum lymph nodes are considerably enlarged, and contain much calcified deposit. The dome of the right diaphragm is flattened and the right costophrenic sulcus is almost obliterated by adhesions. The left diaphragm is rounded and regular (Fig. 1).

The blood Wassermann was negative. The cerebrospinal fluid showed a four plus Wassermann reaction. The gold sol. reading was 4332110000. Test for globulin was faintly positive.

This case, then, presents a roentgen appearance highly suggestive of healed miliary tuberculosis of the lungs, but a possible complicating factor is the clear-cut history and serologic confirmation of syphilis. Blaine[11] has stressed the normal appearance of the lung architecture between the disseminated calcareous deposits in healed miliary tuberculosis. Considering only the individual lesion it must be apparent that to satisfy the first prerequisite for that unusual condition, gumma of the lung, each healed nodule should have sharp bands of fibrous tissue radiating into the surrounding lung. The above reported case follows those of Blaine in presenting no perceptible fibrosis in the lung tissue intervening between the calcified lesions. Calcification may occur in gummata, but it is unusual. Indeed, Opie and Anderson[3] have used this factor alone in designating healed tuberculosis of the lungs. Further, the multiplicity and the minuteness of the lesions noted in this case would seem ample proof of their tuberculous etiology. Lastly, the existence of an obsolete costo-diphragmatic pleurisy, particularly in view of the antecedent history of its primary origin, is suggestive of a tuberculous background.

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THE EFFECTS OF RADIUM EMANATION ON THE CROWN GALL TISSUE

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Bagg[1-2] (1920) noted pathological changes accompanying intravenous and subcutaneous injections of an active deposit of radium emanation into the body of the white rat and dog. Rats receiving over 10.6 mc. intravenously died within three days. Those animals which received a smaller quantity showed pathological changes. The most aberrant conditions were found in the liver, lungs, kidneys, and spleen. Less marked changes were noted in the bone marrow, adrenals and blood vessels. Similar results were observed on dogs.

In 1921 Bagg further reported on the effects of injections of active deposits of radium emanation on Flexner-Jobling carcinoma. The growth of the tumor was retarded and in some cases the tumor regressed. Bagg contends that the injection resulted in definite histological changes common only to radium effects. The more characteristic cytological changes noted are hyperchromatic and homogeneous nuclei. Edwards and Bagg (1922) buried glass capillaries containing 1 mc. of radium emanation into the corpora striata of dogs. This produced localized destruction of the tissue which extends over an area of one centimeter in diameter about the tubule. The cells beyond are apparently normal. Tissues irradiated and examined at different intervals showed evidence of a distinct progressive effect decreasing with the activity of the emanation.

Levin and Levine (1922–1924) introduced glass capillaries containing radium emanation into normal plant and animal tissues, also into the tissue of mouse carcinoma, and into the tissue of the so-called plant cancers. These authors described a progressive necrosis of the normal and pathological plant tissues in the immediate vicinity of the capillary. The necrosis interfered with the development of the tissue above the region of necrosis. In the mouse carcinoma and in human material Levin (1924) contends that the cancer cells situated at a greater distance from the capillary are influenced by the secondary gamma rays which result from the effects of the beta rays on the cells nearest the radium emanation container.

In view of the contention held by some botanists that the plant cancers, such as crown gall, are analogous to animal cancer and in view of the limited work done on this particular type of growth, it was found desirable to study further the influence of radium emanation on this tissue. Furthermore the results obtained by Levin and Levine (1922–1924) are of sufficient interest to make it necessary to extend their earlier studies. Since a more detailed

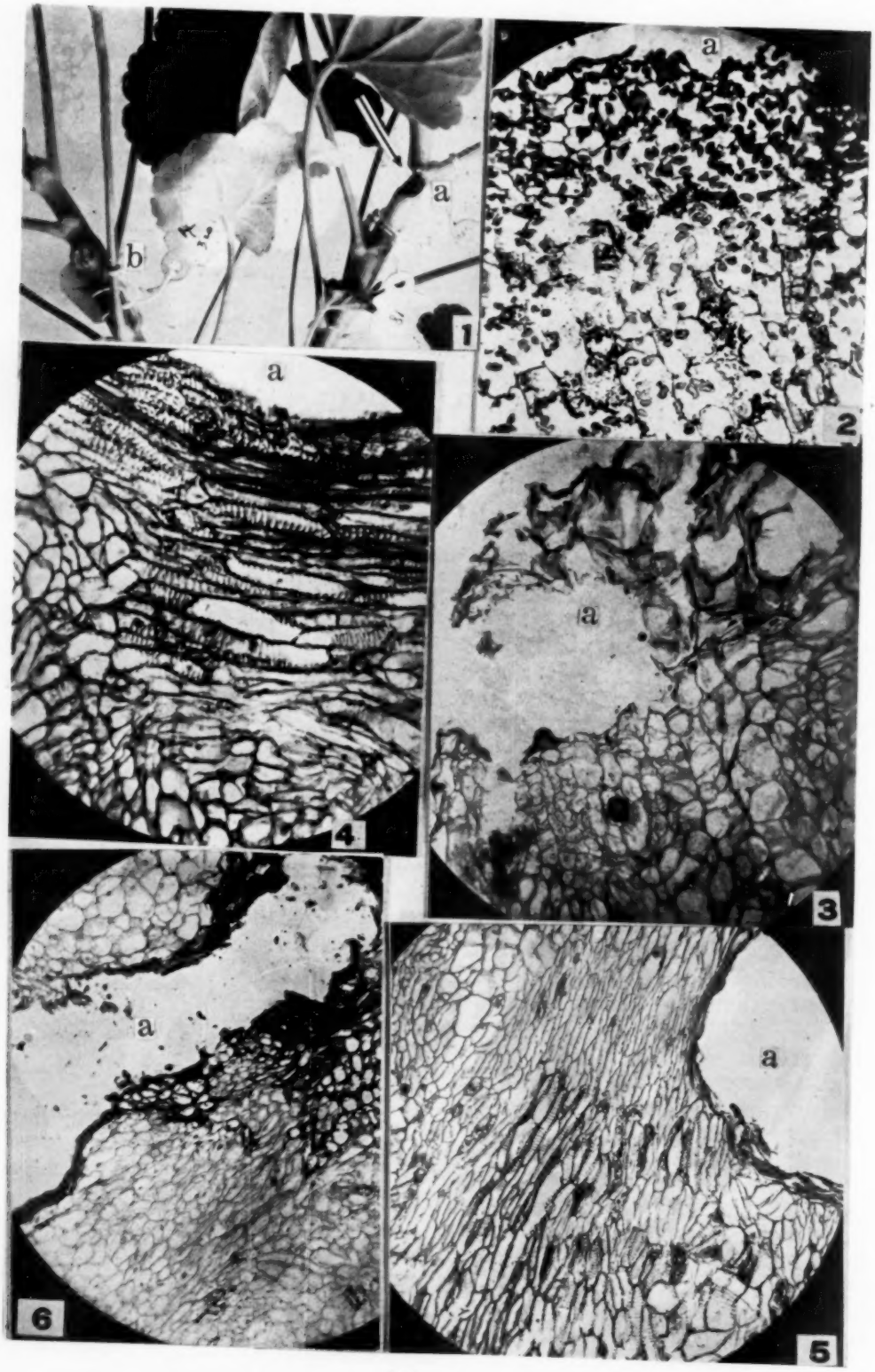

PLATE I.

cytological study on the effects of radium emanation on normal germ cells is now in progress, it is believed that the results obtained so far warrant this report.

In the experiments reported below a great variety of crown gall tissue, with respect to its age, was used. Greater variation in the time of exposure was made. Varying quantities of radium emanation were employed.

METHODS AND MATERIALS

The methods used in these experiments are similar to those I described before (see Levin and Levine 1924). The plants used were young actively growing geraniums. This present report deals primarily with the observations on the crown galls of the geranium, although a large number of gross and microscopic studies were made on the crown gall of *Ricinus*. In the geranium it was found that the young petioles served as excellent material for the production of crown gall within two weeks. The oldest gall on the petiole is sufficiently small to permit of a microscopic study of it in its entirety. It has been found possible to inoculate over 15 petioles on each plant, and each inoculation produces a crown gall of approximately the same size in the same period of time. While over 100 plants with more than one thousand inoculated petioles were studied only the crown galls of three or four petioles in each plant were used. Glass capillaries containing radium emanation were introduced into the galls while other empty glass capillaries were inserted to serve as controls. The apical portions of the stems of the geranium were also used for studying the effects of the emanation on crown galls after a more protracted period.

The quantity of radium emanation used varied from 0.3 mc. to 3.5 mc. and the exposure varied from three hours to several months. Immediately after the inoculation of the petiole or stem with the crown gall organism, *Bacterium tumefaciens*, a jeweler's tag giving the date and hour of inoculation was fastened to each part inoculated. When a capillary containing radium emanation was inserted, another tag was added with the quantity of radium emanation used and the date on which the implantation was made.

The irradiated tissues were killed in Carnoy's solution and in Flemming's strong fixative. The latter solution was more favorable as less plasmolysis occurred and better stained tissues were obtained. Sections were cut from 5 to 15 μ in thickness. They were then stained in gentian violet, saffranin and orange G.

CROWN GALL TISSUE

I have pointed out (Levine 1925) that crown gall tissue is not cancer. It nevertheless represents a specific type of hyperplasia. It results from a division of young cells following an inoculation of *Bacterium tumefaciens*. The overgrowth at first is made up of cells embryonic in appearance but they soon differentiate and cells resembling cortical and fibrovascular elements are formed. The life of these cells is terminable, and follows the usual sequence of events common to the stages found in somatic tissue. Their viability, it appears, is much shortened over the normal cells.

These hyperplasias may at times become malignant in nature. The organ of the plant upon which this neoplasm develops dies as a result. This most frequently results from a mechanical interference with the transportation of the fluids in

PLATE I

FIG. 1. Two branches of a plant thirteen days after inoculation—*a* shows effect of 0.4 mc. of radium emanation implanted 2 days after inoculation; *b* control.[1]

FIG. 2. Photomicrograph of a geranium stem 40 days after inoculation with *Bact. tumefaciens* and 38 days after implantation of 0.4 mc. of radium emanation in a glass capillary; *a* marks the region of the glass capillary (see text).

FIG. 3. Petiole crown gall 14 days old; *a* marks the region of capillary implantation (0.3 mc. of radium emanation used) after an exposure of 3 hours (8 mm. objective used).

FIG. 4. Petiole crown gall 14 days old; *a* marks region of capillary implantation (0.3 mc. of radium emanation used). Note the fibrovascular bundle (8 mm. objective used).

FIG. 5. Petiole crown gall 30 days old exposed to 0.4 mc. of radium emanation. Note vascular elements; *a* represents the region of capillary implantation.

FIG. 6. Crown gall 22 days old exposed to 0.45 mc. of radium emanation; *a* marks the region of capillary implantation.

[1] Photomicrographs were made with D. & L. Bausch and Lomb camera; Zeiss compensating ocular #8, and 16 mm. objective were used. For higher magnification an 8 mm. objective was used. The bellows were extended to 22 cm.

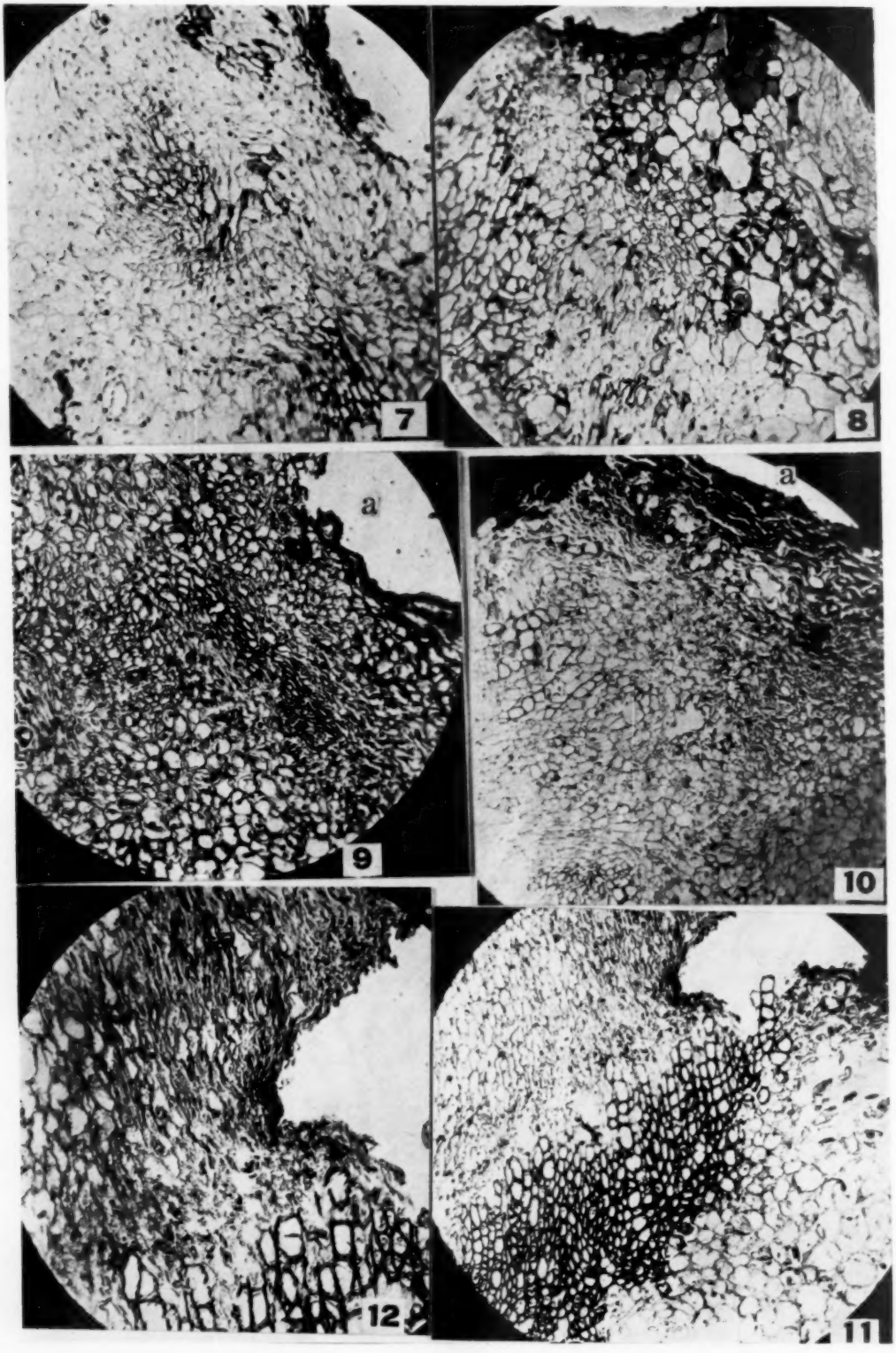

PLATE II.

the fibrovascular system. Only in the case of the rubber plant (Levine 1922) has death of the stem been due to causes other than mechanical obstruction. The study of these overgrowths on a large number of species of plants shows that they are generally of a benign nature. These growths are wart-like in appearance. They develop on the superficial tissues and are relatively small in size. The tissues of the benign growths also become differentiated, senile, and die (Levine 1924). A careful study of the cells in the crown gall tissue shows that karyokinesis occurs without any aberrant phenomena (Levine 1925) so commonly observed in carcinoma and sarcoma of man and animals. In the crown gall tissue on the geranium, cell divisions are relatively few but normal in appearance.

OBSERVATIONS

In the present work a more detailed study of the influence of radium emanation is undertaken. The effort is made to establish more definitely, if possible, the effects produced on young and old crown gall tissue by irradiation with varying small quantities of radium emanation for varying periods of time. The effects of small quantities of radium emanation in glass capillaries, "seeds," on the development of the crown gall disease was first tried. In these experiments the apical portions of young growing geranium stems were used. The upper portions of two branches of each plant tried, were inoculated with *Bact. tumefaciens*. Twenty-four to forty-eight hours later a glass capillary containing 0.3 to 0.6 mc. was inserted into the stem at the point of inoculation. Into the other inoculated branch on the same plant an empty tubule of the same size was inserted to serve as a check.

In all cases the branch which received the "seed" failed to develop a crown gall while the other control branch produced a visible tumor within twelve to fourteen days. Figure 1 shows two branches of a geranium. Two days after the branches were inoculated with *Bact. tumefaciens* a glass capillary containing 0.4 mc. of radium emanation was inserted in the same region of inoculation in branch *a*. An empty tubule of the same size was implanted in branch *b*. The plant was allowed to grow undisturbed. It was noticed in this case, as in all my experiments of this kind, that the stem in the region of irradiation became black in color and apparently dead. A similar phenomenon was observed in healthy growing shoots after implantation of "seeds" (Levin and Levine 1922). The area of necrosis progressed slowly and on the fourteenth day after inoculation when the photograph was taken the black area extended almost across the entire diameter of the stem. The control branch *b* showed a crown gall well developed in proportion to the duration of the disease.

A microscopic examination of a section of a stem (such as Figure 1) through the lower portion of the necrotic area is shown in Figure 2. This section was made from a plant similarly treated but was fixed forty days after the inoculation with *Bact. tumefaciens* and thirty-eight days after a glass capillary containing 0.5 mc. of radium emanation was introduced into the region of inoculation.

There is no evidence of cell growth or proliferation. The cells nearest the region of implantation of the capillary bearing the radium emanation are destroyed. The cell walls are broken and the starch grains appear to be scattered. They appear as deeply stained bodies in the photograph. Small granular bodies resembling bacteria may also be seen. The lower portion of the figure represents cells farther away from the influence of the radium emanation. The cells are apparently normal. The cytoplasm occupies the periphery of these normal vacuo-

PLATE II

FIG. 7. Crown gall inoculated 23 days previously. Exposed to 0.7 mc. of radium emanation for 6 days.

FIG. 8.—Crown gall 30 days old. Glass capillary with 0.5 mc. of radium emanation was implanted 17 days before. Empty cells to the right are normal mature cortical cells.

FIG. 9. Crown gall 30 days old exposed to 1 mc. of radium emanation for 2 days. Necrotic area in region of "seed" is extensive.

FIG. 10. Crown gall 22 days old exposed to 2 mc. of radium emanation for 3 days. Note the wide zone of destroyed cells.

FIG. 11. Crown gall 24 days old exposed to 3.8 mc. of radium emanation for 3 days. Note extensive destruction to left. The effect is reduced in proportion to the distance from capillaries. The center, vascular cells appear to be unaffected while the parenchymatous cells to the right appear to be plasmolyzed.

FIG. 12. The left portion of Figure 11 under higher magnification.

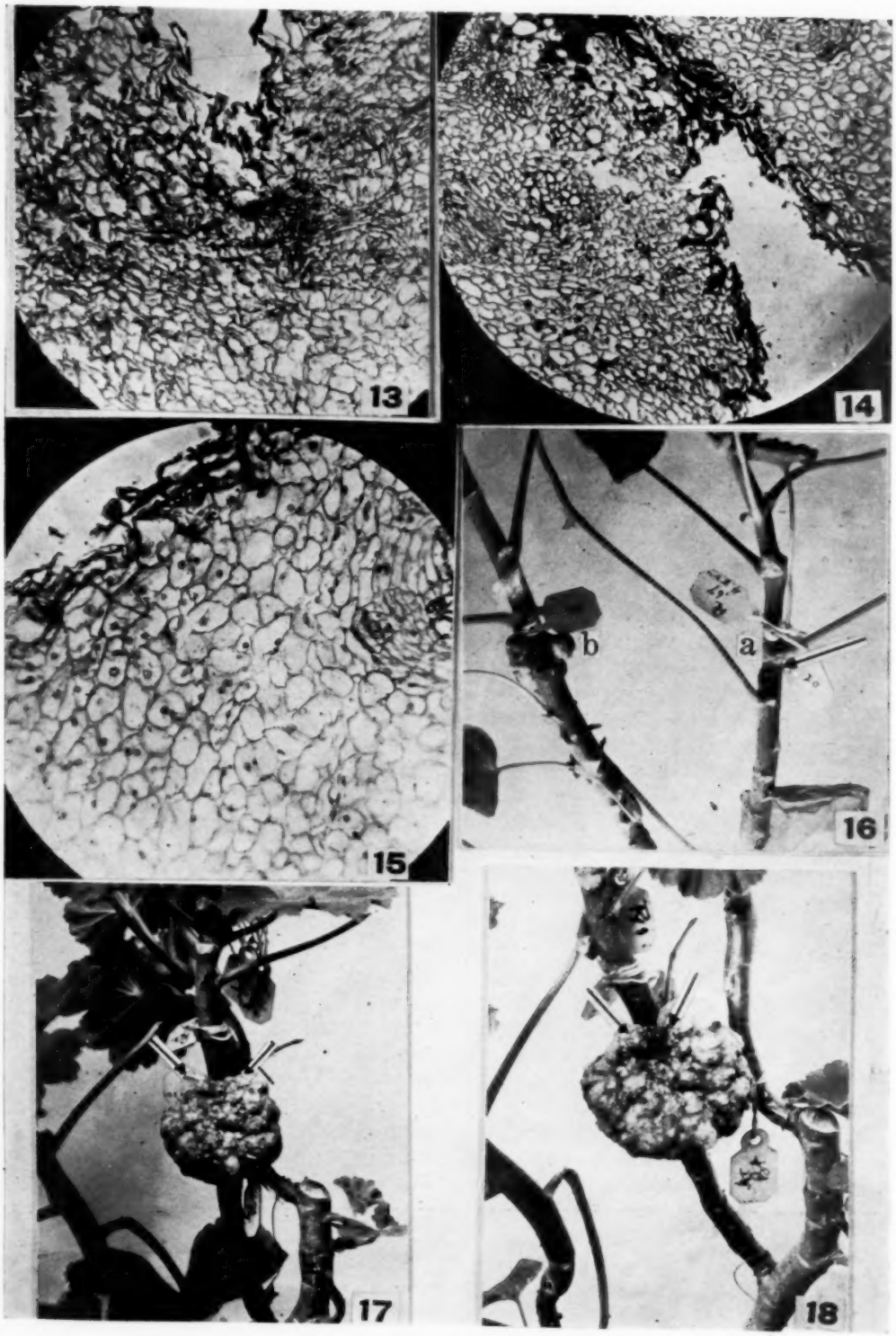

PLATE III.

lated cortical cells. The starch grains are abundant but do not stain so deeply. No nuclei are visible.

The region of the stem below this necrotized zone shows fewer starch grains. These are more uniformly distributed around the periphery of the cell. Nuclei are not distinctly visible in the cells in this field. They are present and occur along the periphery of the cytoplasm.

These observations on the inhibition of crown gall formation through the use of radium emanation are of interest since Riker (1923) found that the application of a hot needle to the region of inoculation did not interfere with crown gall formation.

It would be of interest to study the effect of radium emanation on *Bact. tumefaciens* grown on agar media, the viability of the organism after irradiation to be tested on some of the dicotyledons known to produce crown gall following inoculation with this organism.

SMALL DOSES AND SHORT EXPOSURE

Geranium petioles inoculated with *Bact. tumefaciens* produce intumescences of appreciable size in fourteen days. These growths are considered advantageous because there is a rapid proliferation of the cortical cells without too much differentiation which interferes with the study of the effects of the irradiation. Such crown galls were exposed to small doses of radium emanation for short periods. I have studied over 25 petiole crown galls fourteen days old which were exposed to 0.3 mc. of radium emanation in glass capillaries for three hours. The tubule was buried directly in the tissue which appeared to be active. After the exposure was made the "seeds" were removed carefully and the crown gall was fixed in Flemming's strong solution. After imbedding in paraffin, sections 7 to 12 μ in thickness were stained with gentian violet and saffranin. The same procedure was carried out with crown galls fixed for all periods. The quantities of radium emanation mentioned in all cases represent the strength of the "seed" at the beginning of the implantation.

Figure 3 represents a photomicrograph of a cross section of a petiole through the crown gall and at right angles to the long axis of the "seed." The petiole was inoculated fourteen days previously with *Bact. tumefaciens*. The clear area at *a* represents the region occupied by the capillary. The dark colored boundary line in this figure is not entirely the effect of irradiation. The effect seems to be produced at least in part by the zoögleal stage of the bacteria. The cells lying directly beyond the region appear to be normal. The nuclei, although small, appear to be normal; each nucleus consisting of a rounded nucleolus with a small quantity of chromatic material. The tissue gives the impression of being an actively proliferating one, although relatively few division stages are to be seen.

Figure 4 represents a cross section through another fourteen-day old gall on a petiole. The region *a* marks the position of the glass capillary containing the radium emanation. Spiral vessels are to be seen in the upper part of the photograph near the "seed." Here the nuclei are made clearer by the enlargement and no apparent visible morphological change has been brought about as a result of the irradiation. In some nuclei, where the section of the individual cell is favorable, the nucleoli and chromatic material are well brought out by Flemming's triple stain. These structures compare favorably with the nuclei in normal young portions of growing stems. Fewer division stages are found in the former. The cells that were directly in contact with the "seed" appear to be devoid of cytoplasm and nuclei. This may represent early stages in the destruction of the cells, although the evidence is not very clear on this point. When a capillary containing 0.3 mc. of radium emanation

PLATE III

FIG. 13. Crown gall 30 days old, 3 days after empty capillary was implanted. The debris is the result of the injury. No collapse of cells forming a distinct zone is to be found.

FIG. 14. Crown gall 24 days old. Implantation of empty "seed" made in region of inoculation. Dark masses on analysis are shown to be bacteria.

FIG. 15. Portion of Figure 14 enlarged.

FIG. 16. Effect of implanting 0.67 mc. of radium emanation in glass capillaries on one of two crown galls 19 days old; *a* exposed for 20 days, *b* control.

FIGS. 17, 18, 19, and 20. A few of a series of photographs of an old, yet active crown gall on a geranium after two "seeds" each containing 0.6 mc. of radium emanation were implanted (see text).

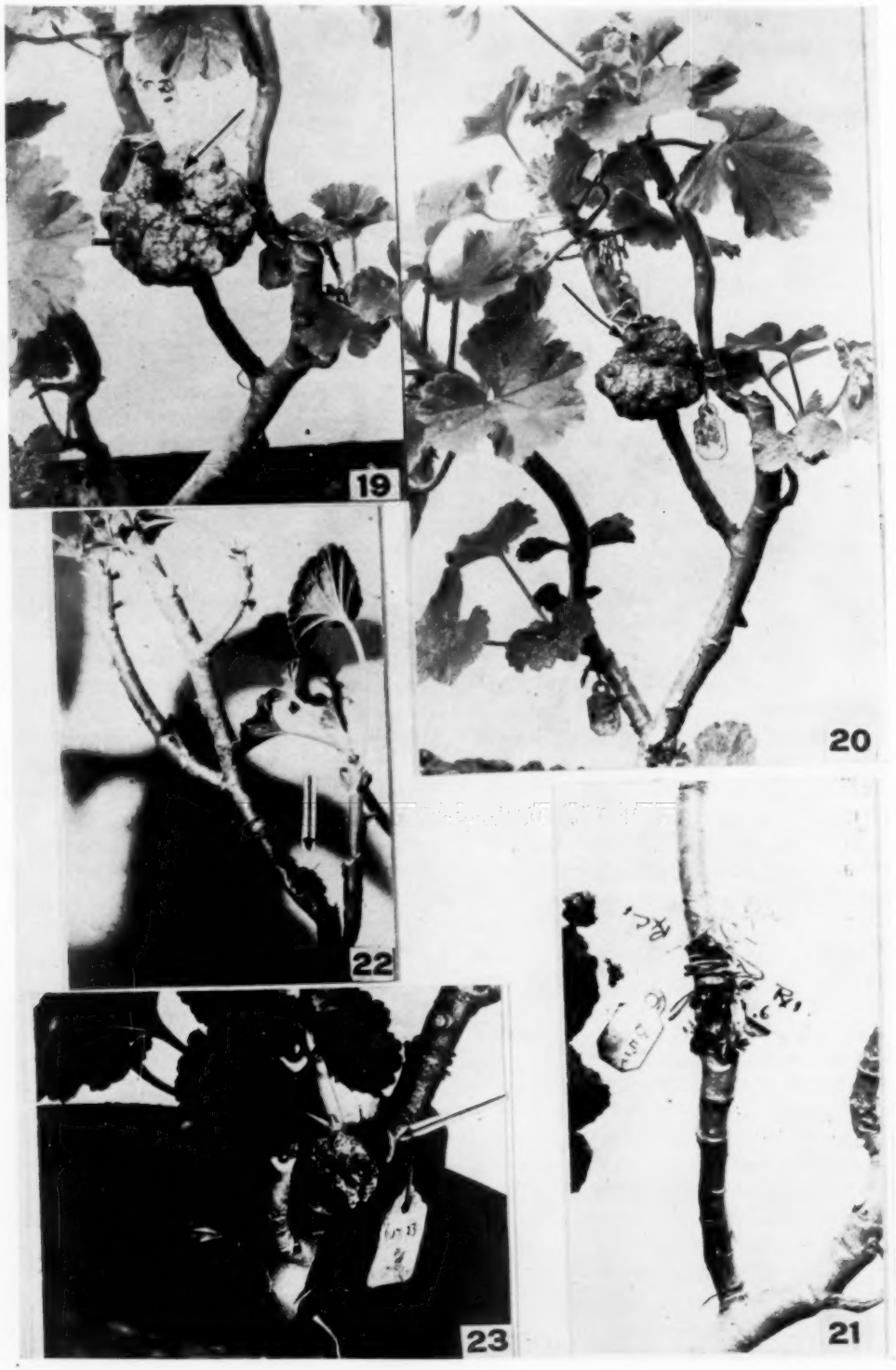

PLATE IV.

FIG. 21. The stem after the dead crown gall tissue was removed.
FIGS. 22 and 23. Two of a series of photographs showing "recurrence" of crown gall at periphery of an old gall. The old gall was exposed to 0.67 mc. of radium emanation.

is inserted into the parts of the gall containing vascular elements the effects are relatively small and show no visible changes.

A large number of petiole crown galls thirty days old have also been studied after subjecting them to similar quantities of radium emanation for similar periods as noted above. The effect is not different from that which has been observed in the young galls. The growths, however, are much larger and differentiation of the tissue is more pronounced.

Petiole crown galls thirty days old were exposed to irradiaion from "seeds" containing 0.3 to 0.4 mc. of radium emanation for fifteen hours. In the sections of these galls visible effects are noted. This consists of a layer of collapsed cells two to four rows in thickness. A close examination of this band shows that the radial walls, with respect to the "seed," have become folded and lie parallel to the surface of the "seed." The cells immediately in back of the cellulose band are most frequently unaffected. Tissues fixed in 5 per cent formol on microscopical examination show cells with homogeneously stained nuclei; i.e., no nucleolar or chromatic substance is recognizable. Fixations made with osmic acid show well differentiated cells with brilliantly stained nucleoli and chromatic material.

Figure 5 represents one of a series of crown galls studied after a fifteen hour exposure. The figure shows a portion of a cross section of a petiole crown gall thirty days old after an exposure to a glass capillary containing 0.4 mc. of radium emanation. The clear space to the right indicates the region occupied by the buried tubule. In the lower portion of the picture vascular elements are to be seen above and around the immediate region of irradiation. The band of collapsed cells mentioned above first appears in crown galls exposed to light doses of radium emanation for fifteen hours. Normal nucleate parenchymatous cells are to be seen beyond the layer of collapsed cells.

Sections were made of petiole crown galls which were exposed to 0.3 to 0.5 mc. radium emanation for twenty-four hours. I have been able to find no marked variation from the results obtained after exposures of fifteen hours as shown in Figure 5.

Petiole crown galls varying in age from twenty to thirty days have been exposed to 0.7 mc. of radium emanation for forty-eight hours. While the number of such studies were relatively few, it appears that the thickness of the layer of collapsed cells about the tubule involves four to nine tiers of cells. The cells surrounding this necrotic layer are not uniformly affected, for one finds necrotized cells which stain as homogeneous bodies with saffranin. Yet cells lying at the same distance from the tubule are well differentiated (Fig. 6). There is no evidence of a progressive necrotizing effect in this tissue at this time.

Together with the above reported experiments I made a large number of control studies. Empty tubes were inserted into petiole crown galls of the same age as those used for irradiation purposes. These controls were fixed, imbedded, and stained with the care exercised with the irradiated specimens. In the control the insertion of the empty glass capillary is responsible for some destruction about the empty "seed." The method of introducing the capillary is responsible for this in a large measure. However, in no case have I found the compact layer of necrotized cells as seen in the irradiated crown galls. The control galls fixed from fifteen to forty-eight hours after an empty tubule was implanted show no effect in the nuclear and cytoplasmic structure of the cells. The cells are all well differentiated as described below.

SMALL DOSES AND LONG EXPOSURE

I have studied the effects of small doses of radium emanation on large crown galls of geranium and *Ricinus* stems varying from twenty to fifty-five days old. As in the earlier experiments mentioned above glass capillaries containing from 0.4 to 0.8 mc. of radium emanation were buried in the part of the crown gall that appeared to be actively growing. These parts appear as greenish-white nodules on the surface of the gall of the geranium. The capillaries were removed from three to eighteen days afterward at intervals of two to three days. Twenty experiments were performed. An equal number of control studies were made. The tissues were then fixed and studied microscopically. A large number of photo-

graphs were made. These photographs were studied together with the sectioned specimens as a means of comparison.

It was found that crown galls exposed to the influence of the radium emanation for from three to eighteen days showed a small zone of necrotic tissue consisting of collapsed parenchymatous cells. This results in the formation of a much thickened cellulose band consisting of collapsed cell walls which surround the "seed." The cytoplasm and nuclear material seem to have disappeared from the cells in this zone. This differs from the fifteen-hour exposures noted above only in degree. Woody elements in the region of the capillaries appear to be but slightly affected.

Figure 6 represents a section through a geranium stem crown gall twenty-two days old. This tissue was exposed to 0.45 mc. for three days. The necrotic area is quite distinct and appears as two dark colored zones on both sides of the channel made by the "seed." The cells slightly removed from this zone are apparently normal and are not different from those observed in petioles after two-day exposures. The effects of the irradiation are best seen in the lower left hand portion of the figure.

Figure 7 represents a section of a crown gall at right angles to the long axis of the "seed." The gall used was twenty-three days old at the time the "seed" was inserted. After a six-day exposure to 0.7 mc. of radium emanation sections of the tissue show a necrotic zone about the "seed." The cells immediately below the field of irradiation are somewhat smaller. These are not the results of subsequent growth but appear to be due to the pressure of the necrotic zone. The nuclei which are very small are the same as those in the zone of cells far removed from the influence of the irradiation. The spiral vessels seen in the center of the figure are normally differentiated crown gall tissue and are not visibly affected by the irradiation.

Figure 8 represents a section through a crown gall forty-eight days old. The tumor was exposed to 0.5 mc. of radium emanation for eighteen days. The position of the "seed" is indicated by the clear area in the upper part of the figure. The necrotic zone is not much wider than that observed in the other galls. The cells immediately following the band of collapsed cells are apparently normal although no cytoplasm and nuclei appear. There is no evidence to attribute this to the destructive influence of the radium emanation. It appears from a study of many microscopic sections that the tissue used was old at the beginning of the exposure or that the tissue became differentiated after the radiant energy was exhausted. This variation in the structure of crown gall tissue has been pointed out by me before (Levine 1919). Very little evidence is found to show that these cells beyond this deeply staining zone of collapsed cell walls are affected by the irradiation. The cellular phenomenon normal to crown gall tissue may often mislead one. The control experiments which I am describing below point rather clearly to this conclusion.

EFFECTS OF LARGER DOSES

The effects of relatively large doses of radium emanation on crown gall tissue for short periods have been studied. Intumescences on stems of geranium twenty to thirty-five days old irradiated with 1 to 3 mc. of radium emanation showed after from two to seven days larger necrotic zones from 1 to 3 mm. in diameter. Sections of the galls through the region of "seed" implantation show the necrotic area to be made up of collapsed cells as noted above. The extent of the necrosis is wider in diameter than that produced with small doses.

In Figure 9 is shown a photomicrograph of a section of a crown gall thirty days old exposed to irradiation from 1 mc. of radium emanation for two days. The point of interest in this section is the lack of cytoplasm and nuclei in the cells following the necrotic zone. There is also a layer of fibrovascular bundles in the upper middle of the field. The sections show very clearly well-developed nuclei without any visible disturbance. Figure 10 was made from a section of a crown gall twenty-two days old after an exposure of three days to 2 mc. of radium emanation in a glass capillary. The necrotic zone is much wider than that shown in Figure 9 and a number of cells

immediately beyond the zone of destroyed cells are devoid of cytoplasmic structure or nuclei. These cells show what appears to be a transition stage in the progressive necrosis observed in the gross. The empty cells seen in the figure are not to be associated with effects of irradiation but are constant features of mature crown gall tissue. Note the cavity in center of the field shown in the figure.

Figure 11 represents a section through a crown gall twenty-four days after an exposure to 3.8 mc. of radium emanation for three days. Here the center of the tissue is occupied by empty wood cells which extend from the region of the insertion of the "seed," diagonally across the tissue. These wood cells appear to be unaffected. The parenchymatous cells to the left, shown under a higher magnification in Figure 12, are in a transition stage. They appear to be undergoing necrosis. The large cortical cells to the right appear to be visibly affected also (Fig. 11). The cells are somewhat plasmolyzed yet the nuclei are distinctively stained. The cells so affected form a layer of tissue which extends only for a small distance, approximately 2 to 3 mm., about the "seed." Beyond this region cells are nucleate and apparently normal. The assumption, that the zone of necrotized cells formed around the capillary serves as a filter for the beta rays so that the effect of the gamma rays may be observed at a distant point, may find support in this preparation. However, I have been unable to find in these somatic cells of crown gall any evidence other than the marked destruction of the cells lying close to the glass capillary filled with the radium emanation. These necrotic effects have been observed in animal and human pathological tissue. It appears from these studies that small doses of radium emanation implanted in crown gall tissue affect a very limited zone of cells about the "seed." The cells become necrotized about the capillary and transformed into a distinct homogeneous layer of deeply staining cell walls. The cytoplasm and nuclei of the cells which form this necrotized layer disappear. Further, the zone seems to progress slightly in extent. Transition stages although present do not seem to be well defined. Occasionally one finds homogeneously stained cells in regions immediately beyond the collapsed zone of cells.

CONTROLS

In my control experiments referred to above, some of the sections of which are shown in Figures 13, 14 and 15, empty glass capillaries were inserted into crown galls inoculated twenty to thirty days previously. In these sections it is clear at once that little or no necrotic tissue similar to that found in the irradiated tissue is to be found. In Figure 13 a photomicrograph of a section of crown gall twenty-nine days old is shown after an empty "seed" had been inserted three days earlier. There are a small number of dead cells about the opening made by the needle used to introduce the capillary. Figure 14 represents a section from a crown gall fourteen days old after an empty tubule had been implanted in its tissue for nine days. The dark band lining the opening made by the inoculation is due to the bacteria. The cells immediately following the dead cells are however normal and show clearly differentiated nuclei as seen in Figure 15, photographed under a slightly higher magnification. The injury done is more extensive than that in most control sections that I have studied. The difference between the irradiated and non-irradiated tissues is obvious. While the cause of necrosis is undoubtedly due to the radium emanation, I have undertaken for further study the cytological effects produced by filtered and unfiltered radium emanation in glass capillaries on the spermatogenesis of the flowering plants. This it is hoped will aid in determining the effects of the gamma and beta rays on the cells. It appears that the effects noted above are necrotic and represent the combined effects of the gamma, beta and secondary rays, the effects of the latter two over-shadowing those of the gamma radiations.

GROSS EFFECTS OF RADIUM EMANATION

Gross studies of crown gall tissue irradiated with relatively small doses of radium emanation and exposed for long periods seem to indicate only that the tumors

regress and die as a result of the irradiation. A careful study of these irradiated growths convinced me that the regression and death of the tissue is confined to a small area about the needle as shown by means of microscopic studies referred to above. The areas affected first show a progressive extension of the necrosis. This reaches a limit at 1 to 3 mm. and then progresses no farther. Often the crown gall dies. This is not entirely attributable to the influence of the irradiation, but rather to the regression and death that occurs in the life of the gall. In Figure 16 *a*, two branches of the same geranium inoculated with *Bact. tumefaciens* are shown. When the galls were twenty days old, the one on *a* was irradiated by burying a glass capillary containing 0.7 mc. of radium emanation. A small necrotic area appeared twenty-four hours after irradiation. The area progressed 0.5 to 1 mm. in three days and then no further change was noted. Twenty days later, when the photograph was made, the crown gall at *a* had shrunk so that only a black wrinkled patch remained on the surface where the small crown gall first appeared. The control at *b* was still actively growing. It appears that the small necrotic area alone is due to irradiation. The complete necrosis of the crown gall tissue frequently occurs without the intervention of any necrotizing substance. All wart-like tumors that appear after inoculation with *Bact. tumefaciens* die in this fashion before the host is affected. It is quite possible that the induced necrosis, although small in proportion, may be responsible for an earlier death of the tissue. Cutting away a part of a young overgrowth does not have this effect. There results are consistent with my observations on the effect on normal stems of buried capillaries containing radium emanation.

In old galls such as the one shown in Figure 17 and the succeeding stages, similar results were observed. Two glass capillaries containing 0.6 mc. of radium emanation each were inserted into the upper portion of the crown gall. The "seeds" were inserted so that only the crown gall tissue would be irradiated. Empty glass capillaries were introduced into the lower part of the same gall. The tumor was a slowly growing one, but active on the surface. Photographs were made of this crown gall at intervals of three to four days. Figure 17 shows the appearance of the gall thirteen days after the introduction of the radium emanation. The region occupied by these tubes shows two small black areas about 1 mm. in width about the "seeds." The control "seeds" are entirely covered by the growing tissue. The same gall seven days later (Fig. 18) shows the dark areas unchanged. A lighter zone of discolored tissue extending 3 to 5 mm. about the "seed," and a marked depression of the tissue in the region are now quite noticeable. In Figure 19 the gall is shown thirty-three days after the exposure. The two small black areas have fused and are indistinguishable from the larger zone of necrotized tissue about them. The rest of the tissue about this region is apparently normal crown gall tissue. The depression about the "seed" has increased somewhat. The rest of the branch is apparently unaffected. The gall fifty-three days after the beginning of the exposure (Fig. 20) shows the deeply colored necrotic area about the "seeds." The remainder of the crown gall has died. This part of the gall has shriveled but is quite distinct in color from the irradiated part. The branch seems to be unaffected. On removing the mass of dead crown gall tissue it was found that the crown gall was dry and powdered easily. A part of the geranium stem (Fig. 21) is destroyed.

It appeared at first as if the entire gall had been destroyed by the irradiation. An analysis of this material, however, shows that the only part of the crown gall affected by the radiant energy is that part which shows the dark zone about the "seeds." This necrotic zone appeared relatively soon after the capillaries were implanted. The death of the rest of the crown gall occurred separately. It appears here also that death of the tissue resulted in the normal development of the disease. This may have been hastened by the induced necrosis.

Another study of the effect of radium emanation on crown gall tissue that appears to be of interest, was carried on

for over a year. It was found that the radium emanation had little effect on the "recurrence" of crown gall disease when applied to one part of the gall. The evidence shows here also that the irradiation affects a small limited area and does not inhibit the further development of the disease. Figure 22 shows a photograph of a geranium which was inoculated with *Bact. tumefaciens* on the lower portion of the stem. Two months later a small growth had developed into which was implanted a glass capillary containing 0.67 mc. of radium emanation. The photograph shows the plant six months after the "seed" was buried in it. The crown gall had dried up and represents a mass of dead parenchymatous cells. The same plant, six months later, is shown in Figure 23. From the margin of the old crown gall a new mass of crown gall tissue has formed. Such "recurrences" are not uncommon in the crown gall disease as reported (Levine 1924) for the apple tree, rose and rubber tree crown galls. It appears that the life history of the crown gall is little interfered with by radium emanation except in a small area about the "seed." This further emphasizes the inefficacy of a "seed" on the entire gall as shown above. The "recurrences" are presumably a reinfection of young tissues due to the specific bacteria which lived over a period of inactivity. The awakened activity is possibly due to the resumption of conditions favorable to the growth of the host.

SUMMARY AND CONCLUSIONS

1. Short exposures of crown gall tissue to small doses of radium emanation (0.1 to 0.6 mc.) sealed in glass capillaries which are implanted in the crown gall tissue produce little effect on the surrounding tissues.

2. Longer exposures and larger doses of the same active substance induce necrosis of tissues immediately surrounding the tissue extending progressively to a radius of 0.5 to 5 mm.

3. The visible microscopic effects resulting from the unfiltered irradiation of radium emanation appear to be caustic in effect.

4. The general effects produced by radium emanation on crown gall are similar to those produced in normal somatic plant tissue.

5. Further studies which tend to eliminate the effects of the beta and secondary rays on the tissue should be undertaken.

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THE INFLUENCE OF ULTRAVIOLET RADIATION UPON THE TAKES AND GROWTH OF TRANSPLANTABLE RAT AND MOUSE CARCINOMATA IN ALBINO RATS AND MICE*

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THE application of sunlight in the treatment of disease processes is one of the oldest known therapeutic measures. There are, however, no experimental records showing to what extent sunlight affects neoplasms.

During the summer months of 1922 and 1923, we carried out several experiments to determine what influence, if any, sunlight might have on the development of transplanted tumors in albino rats. The young adult rats, usually five in each group, before and after inoculation with tumor tissue, were placed in a cage made of wire netting having a large mesh, and exposed to direct solar radiation daily, except on overcast days, at some time between the hours of 9 A.M. and 3 P.M. when the sun's energy is most effective. The experimental results, as well as other conditions of the experiments, are presented in Table 1.

The results of the experiments in 1922 showed that the percentage of tumor takes in the animals previously treated with sunlight was somewhat below the normal. The difference was not marked and was not apparent in those animals similarly treated in the summer months of 1923.

In order to determine the possible effect of sunlight upon the progress of the grafted tumors we continued these exposures to the sun's rays for five weeks after grafting. The results of these experiments showed that the progress of the tumor grafts in rats exposed to sunlight was identical with that of the control animals which were kept in a room under ordinary laboratory conditions.

In the light of the questionable effect of natural radiation on the production of resistance against transplantable animal cancer, and in view of the recent increase of interest in radiation therapy in cancer it appeared advisable to make additional experiments with artificial radiation.

TABLE 1

THE INFLUENCE OF SUNLIGHT UPON TUMOR SUSCEPTIBILITY IN ALBINO RATS

Date of Experiment	Tumor Tissue Used	No. of Animals Used	Daily Exposure to Solar Radiation in Hours	No. of Times Exposed before Tumor Inoculation	Time Elapsed in Days between First Irradiation and Inoculation	Percentage of Tumor Takes
June–July, 1922	FRC	10	2	10	10	80
	102C	5				100
July–Aug. 1922	FRC	5	0 3	0 5	0 5	60
	103D	5				80
July–Aug., 1922	FRC	5	0 3	0 10	0 10	0
	103E	5				100
Sept.–Oct., 1922	FRC	10	0 3	0 8	0 8	100
	105B					100
May–June, 1923	FRC	5	0	0	0	
	112A	8	3	10	10	100 100
May–July, 1923	FRC	5	0	0	0	
	112C	8	3	19	22	100 80
June–July, 1923	FRC	5	0	0	0	
	113D	10	3	6	7	90 80
July–Aug., 1923	FRC	5	0	0	0	
	113E	8	3	2	2	100 80
July–Aug., 1923	FRC	5	0	0	0	
	114D	10	4–5	8	13	90
		5	0	0	0	100

The radiation from a quartz mercury arc lamp is rich in ultraviolet rays and has proved its value in the treatment of skin diseases[1–7]. Sampson[8] has employed ultraviolet radiation in conjunction with roentgen rays for the treatment of skin cancer. The essential feature of this combined method of therapy is that the first application of ultraviolet light renders the exposed area more resistant to the subsequent radiation with roentgen rays. De Coulon[9] has studied the action of light representing different portions of the visible spectrum upon sarcoma and epithelioma in mice. He found that radiation in the neighborhood of λ650, of λ550 and of λ500 coincided with a rapidity of growth of sarcoma in the mice as in that of the controls, whereas

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radiation in the neighborhood of λ600 and of λ525 coincided with an inhibition of the development of the tumor grafts. He found that the fractional spectrum situated in the neighborhood of λ650 has a retarding action on the development of epithelioma, whereas the extremity of the visible spectrum beginning at λ600 has an activating action.

The experiments reported in this paper were planned, (1) to demonstrate whether or not radiation emitted from a quartz arc lamp induces a resistance of animals to transplantable carcinomata; and (2) to determine the destructive dose of the ultraviolet radiation on cancer cells *in vivo*, as well as *in vitro*.

EXPERIMENTAL METHODS AND RESULTS

In the present study we used the Flexner-Jobling rat carcinoma and the Bashford mouse carcinoma. The subcutaneous inoculation of the tumor fragments into new hosts was done by the trocar method,[10] and the tumors were allowed to grow for a period of six weeks.

The source of the ultraviolet radiation was a Cooper-Hewitt, 110 volt quartz mercury arc lamp, with lamp operating at 89 volts, 3.3 amperes. The quartz mercury tube, 1.7 cm. diameter and 8.5 cm. long, was closely enclosed in a metal casing which had a slit of 8.5 mm. On account of the heat of this lamp, an electric fan was used throughout the experiments to reduce the temperature to about 25° C.

EFFECT OF ULTRAVIOLET RADIATION UPON CANCER TISSUE IN VITRO

The extent of injurious action of ultraviolet radiation is related to the amount of radiant energy absorbed by the tissue. This depends on various factors, of which the intensity of radiation used, and the distance and time of application are the most important ones. It seems advisable to determine at first the dose of radiation necessary to inhibit the proliferating capacity of cancer cells *in vitro*.

Six or seven small particles of tumor tissue each weighing about 4 mgm. were placed in a transparent quartz tube, 11.5 by 2.8 cm., and 2 mm. thick, having a conical bottom. The tube contained 30 c.c. of a Locke-Ringer solution previously adjusted to pH 7.0 and sterilized. The tube containing the tumor fragments was placed at a distance of 4 inches from the quartz mercury vapor lamp for every treatment and exposed to the radiation for definite intervals of time of from 5 minutes to 90 minutes. The solution was agitated in order that the deposited tumor fragments should receive a uniform effect. At the end of this period of time, tumor fragments were transplanted into rats subcutaneously. As a control, the same number of animals were implanted with nonirradiated tumor tissue which had previously been immersed in a Locke-Ringer solution. Some of the irradiated and nonirradiated tumor tissues were fixed in formaldehyde solution for histological examination.

The data obtained from these experiments are given in Table II.

TABLE II

GROWTH OF TRANSPLANTED FLEXNER-JOBLING RAT CARCINOMA AFTER EXPOSURE TO ULTRAVIOLET RADIATION IN VITRO

Exp. No.	Tumor Tissue Used	No. of Rats Used	Kind of Filter	Duration of Exposure in Min.	Percentage of Tumor Takes	Remarks
1	FRC 129C	5	quartz	5	100	One tumor grew slowly; the rest grew rapidly.
2	FRC 129B	5	quartz	10	60	Two tumors did not grow; with one tumor, no growth in first week, normal thereafter; others grew normally.
3	FRC 126D	5	quartz	15	40	Three tumors did not grow; with one tumor, no growth in first week; with one tumor, no growth in second week; normal growth thereafter.
4	FRC 125D	5	quartz	30	40	Three tumors did not grow; with two tumors, no growth in first week, normal growth thereafter.
5	FRC 127B	5	quartz	30	0	Three tumors did not grow; two tumors retrogressed after first week.
6	FRC 126C	5	quartz	30	0	Tumors did not grow.
7	FRC 128B	5	quartz	30	0	Tumors did not grow.
8	FRC 127C	5	quartz	60	0	Tumors did not grow.
9	FRC 126C	5	quartz	60	0	Tumors did not grow.
10	FRC 127D	5	quartz	90	0	Tumors did not grow.
11	FRC 128A	5	glass	60	100	Normal growths.
12	FRC 129C	5	glass	60	100	The growth of the transplants somewhat delayed. Four tumors grew slowly, one grew rapidly.
13	FRC 129A	5	glass	90	40	Three tumors did not grow; with two tumors, no growth in second week, normal growth thereafter.

It is quite evident that the transplantable rat carcinoma is sensitive to the ultraviolet radiation from a quartz mercury arc lamp. The proliferating capacity of the transplants was completely destroyed by the radiation in 60 minutes of exposure. The destructive action of the radiation was diminished, however, with decrease in the length of exposure. Thus, with 30 minutes of exposure the growth energy of the irradiated tissues was not totally destroyed, as seen from the subsequent growth, and it was found that some of the tumor tissues was partially affected. With 15 and 10 minutes of exposure, less inhibitory action than with 30 minutes of exposure was noted, though some of the irradiated tissues were made completely inactive. No effect was observable with 5 minutes of exposure, the growths being practically the same as in the controls.

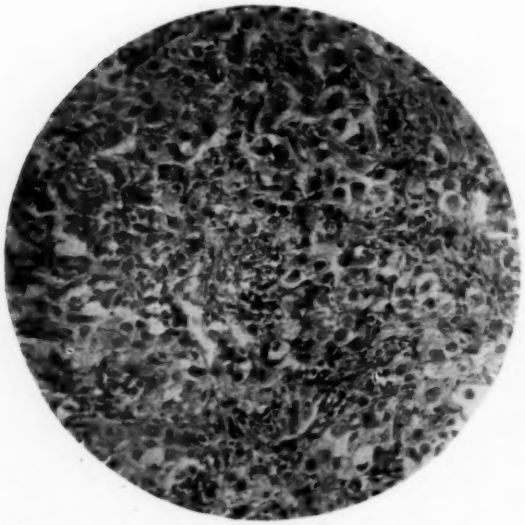

FIG. 1. Nonirradiated tumor tissue of the Flexner-Jobling rat carcinoma.

FIG. 2. Shows the effect upon the same tumor exposed for 60 minutes to ultraviolet radiation. The picture shows fibrosis and destruction of cytoplasm.

A Locke-Ringer solution which had been previously irradiated did not affect the growth energy of tumor tissue, indicating that the inhibitory action of the radiation is a direct one. There is an interesting fact in connection with our present study. Pacini[11] has pointed out that if to a sample of water which has been sterilized with ultraviolet radiation fresh live bacteria are added, within an hour's time practically 90 per cent of the organisms are killed. It seems then that cancer cells, unlike bacteria, are quite resistant to this residual effect.

In order to eliminate one other factor, that is a "heat effect," from the possibility of inhibitory action upon the tumor tissue, we made experiments using a glass tube which was nearly identical in size and thickness with that of a quartz tube. It was found that the growth energy of the Flexner-Jobling rat carcinoma was not altered until 90 minutes of exposure were applied; there was no effect with 60 minutes of exposure (Table 11). It is well known that ordinary glass is not entirely opaque to ultraviolet radiation.

The histological examinations of a number of the tumor tissues after exposure to the radiation from a quartz mercury vapor lamp for varying lengths of time were kindly made by Dr. James Ewing. The general structure of nonirradiated tissue that has been immersed in a Locke-Ringer solution for 60 minutes showed cellular alveolar carcinoma, many large cells, some hydropic degeneration, considerable fibrosis and numerous lymphocytes and polynuclear leucocytes (Fig. 1). The proliferating capacity of this tissue was not

altered. The sections of tumor tissue which had been exposed to ultraviolet radiation for 5, 10 and 15 minutes showed a similar picture to those which were not irradiated. The growth energy of the transplants which had been exposed to the radiation for from 10 to 15 minutes was distinctly reduced. A microscopic examination of tumor tissue exposed to ultraviolet radiation for 30 to 60 minutes was made. The former showed considerable hydropic swelling of cells, otherwise similar to those not irradiated, while the latter showed very marked hydropic swelling of tumor cells and destruction of cytoplasm (Fig. 2). It was found that under these conditions the proliferation was completely inhibited.

In 1913, Rous[12] studied the effect of ultraviolet light emitted from an Heraeus mercury-quartz lamp on the activity *in vitro* of fresh and dried sarcomatous tissue of the fowl. He found that prolonged exposure of fresh tumor tissue to the light retarded the development of the transplants; but it did not affect the dried tumor material. He concluded that in the sarcomatous tissue of the fowl there are two elements capable of producing growth, one of which will withstand drying while the other will not, and that ultraviolet light has a destructive action upon the sarcoma cells without notably injuring the etiological agent that is associated with them. Recently Pentimalli[13] has shown that development of chicken sarcoma in pectoral muscle was not impaired by irradiation with ultraviolet rays. Further, he observed that irradiation of the tumor emulsion or of the filtrate from the tumor solution did not succeed in destroying the proliferating capacity of the tumor. Thus, our results with mammalian tumors, and the results of Rous and Pentimalli with chicken tumors indicate clearly that the sensitiveness of the transplantable mammalian and avian tumors to ultraviolet rays is quite different. It is interesting to note that the capacity for transplantation of the rat and mouse tumors is completely destroyed by desiccation; and that the filtrate of the tumor emulsion does not contain that material, which, when transplanted, gives rise to the tumors. On the other hand, the causal agent of the chicken sarcoma is not destroyed by desiccation, and furthermore a transplantable agent will pass through Berkefeld filters.

EFFECTS OF ULTRAVIOLET RADIATION UPON TRANSPLANTED TUMORS

Investigations upon the action of ultraviolet radiation upon the development of transplanted tumors in rats and mice were next made. For this we carried out two different types of experiments. In the first experiment young albino rats were used. The entire body of the animal was subjected daily to the radiation, without a filter, at a distance of 4 inches. The treatment was begun a day after tumor transplantation and continued for four weeks. We made three sets of experiments. In each set 15 tumor-inoculated animals were divided into two groups and 10 rats in one group were exposed to the ultraviolet radiation for 5, 10 and 15 minutes daily, respectively. The remaining animals were not irradiated, and were used as controls. Results from these experiments showed that in all three groups none of the animals that underwent irradiation exhibited abnormality of the tumor growth. Their tumors grew rapidly, except two tumors which grew slowly. The biological effects of ultraviolet radiation on rats may be briefly summarized as follows: Daily exposures of 5 minutes has a slight retarding influence upon the body growth of the rats. Exposures of 10 minutes generally prevented the body growth while a small number of the group showed only one-third the normal rate of body growth. These animals showed occasionally closing of the eyelids which lasted for several days at a time; but no permanent blindness was noted. The rats which received a daily dose of 15 minutes of exposure were markedly affected. They did not grow, though most of them maintained their body weight; some, however, lost weight. Their general appearance was poor; eyelids were closed but not permanently; some showed partial paralysis of the legs, and some died after repeated exposures during two weeks.

In the second part of the present experiments we used adult albino mice. The piece of tumor tissue (Bashford mouse

carcinoma) was inoculated subcutaneously in the ventral region, and treatment begun on the following day, or later, when the tumor had reached a large size. The mouse was fastened to a board, the ventral surface facing directly the source of the ultraviolet radiation, and was treated at a distance of 4 inches from the mercury arc. During the irradiation the whole body, except the site of grafted tumor tissue, was protected from the radiation by a thin sheet of paper.

Results of preliminary experiments indicated that mild irradiation had no influence upon the development of the transplants. On the other hand, sometimes there was a diminution in the size of the tumors and the destruction of tumors when animals showed severe surface skin reactions. It was found that several exposures of from 5 to 7 minutes were required to affect the tumor growth. These doses produced on the exposed surface the following reactions: erythema, pigmentation, inflammation, alopecia, and ulceration of the skin.

Retardation of body growth always followed irradiations. The effect from 10 minutes' exposure was even more marked and produced death in some mice.

The results of local treatment of Bashford mouse carcinoma by ultraviolet radiation are presented in Table III.

The results shown in Table III seem to indicate that the radiation from a quartz mercury arc lamp produces both inhibitory and stimulating effects upon the growth of Bashford mouse carcinoma. The development of very small transplants in some animals is completely inhibited by the radiation. The growth of week old tumors, about 3 × 3 mm., is checked while under treatment; but resumption of tumor growth was noted when the irradiation was discontinued. Some of these irradiated tumors grew very rapidly. The growth of large tumors was not affected by the repeated irradiation. However two large treated tumors have completely retrogressed after hemorrhage and ulceration.

TABLE III

RESULTS OF LOCAL TREATMENT OF BASHFORD MOUSE CARCINOMA BY ULTRAVIOLET RADIATION

Number of Mouse	Size of Tumor in Mm.	Duration of Exposure in Minutes	No. of Exposures	Result of Irradiation
816	2.5 × 2.5	1	5	Tumor grew normally.
817	2.5 × 2.5	1	5	Tumor grew normally.
818	2.5 × 2.5	1	10	Tumor grew slowly.
819	2.5 × 2.5	1	10	Tumor grew rapidly.
820	2.5 × 2.5	1	15	Tumor grew normally.
840	2.5 × 2.5	3	5	Tumor grew slowly.
841	2.5 × 2.5	3	5	Tumor grew normally.
842	2.5 × 2.5	3	10	Tumor grew normally.
843	2.5 × 2.5	3	10	Tumor grew slowly while under irradiation; normal growth thereafter.
844	2.5 × 2.5	5	5	Tumor did not grow.
845	2.5 × 2.5	5	5	Tumor grew normally.
847	2.5 × 2.5	5	10	Tumor grew very slowly.
848	2.5 × 2.5	5	10	While under irradiation the tumor grew very little; on cessation of treatment the tumor grew very rapidly.
846	3 × 3	5	10	Tumor retrogressed.
901	2.5 × 2.5	7	3	Tumor grew normally.
902	2.5 × 2.5	7	3	Tumor grew for two weeks, then retrogressed.
903	2.5 × 2.5	7	3	Tumor grew rapidly.
883	2.5 × 2.5	7	5	Tumor grew slowly for 7 days; normal growth thereafter.
884	2.5 × 2.5	7	5	Tumor grew normally.
885	2.5 × 2.5	7	5	Tumor grew slowly.
886	2.5 × 2.5	7	5	Tumor did not grow.
887	2.5 × 2.5	7	5	Tumor did not grow.
888	2.5 × 2.5	7	5	Tumor grew normally.
889	2.5 × 2.5	7	5	The development of tumor delayed for two weeks, normal growth thereafter.
890	2.5 × 2.5	7	5	Tumor did not grow.
891	2.5 × 2.5	7	7	Tumor did not grow.
872	2.9 × 2.9	7	7	While under irradiation the tumor grew very little; on cessation of treatment the tumor grew more rapidly than normally.
873	3 × 3	7	7	While under irradiation the tumor did not grow; on cessation of treatment the tumor grew more rapidly than normally.
870	3.5 × 3.5	7	7	While under irradiation the tumor grew not at all; on cessation of treatment the tumor grew normally.
874	3.9 × 4.5	7	7	While under irradiation the tumor did not grow; on cessation of treatment the tumor grew more rapidly than normally.
875	4.2 × 4.4	7	7	While under irradiation the tumor did not grow; on cessation of treatment the tumor grew more rapidly than normally.
830	8.5 × 8.2	5	2	Tumor grew normally.
862	8.9 × 10	7	2	The tumor became hemorrhagic, the growth stopped, retrogressed completely after 19 days.
856	9.2 × 9	5	12	Tumor grew normally.
846	10 × 10.5	5	10	Tumor became hemorrhagic, ulcerated, has retrogressed completely 26 days later.
840	10.8 × 12.1	7	4	Tumor grew normally.
860	11.8 × 13	7	7	The growth of tumor was normal.
819	14.5 × 18.5	7	5	Tumor ulcerated, animal died 12 days later.

THE INFLUENCE OF ULTRAVIOLET RADIATION UPON TUMOR SUSCEPTIBILITY IN ALBINO RATS AND MICE

The experiments reported in this paper were planned mainly to demonstrate whether or not radiation emitted from the quartz mercury arc lamp induces a resistance of animals to transplanted cancer.

The general routine of the experiment and results may be summarized as follows:

Young Adult Rats. The entire body of the animal was subjected to the radiation without a filter at a distance of 4 inches, and treated with a single dose or repeated doses. At the end of definite periods of time after irradiation the animals were inoculated with the Flexner-Jobling rat carcinoma at the right axilla, and the tumor was allowed to grow for a period of six weeks. The experimental results are presented in Table IV.

TABLE IV

RESULTS OF TRANSPLANTING FLEXNER-JOBLING RAT CARCINOMA IN RATS WHICH HAD BEEN EXPOSED TO ULTRAVIOLET RADIATION

Exp. No.	Tumor Tissue Used	No. of Rats Irradiated	Duration of Daily Exposure in Min.	No. of Exposures	Time Elapsed in Days between First Irradiation and Inoculation	Percentage of Tumor Takes
1	FRC 127E	5	10	1	7	100
2	FRC 127E	5	10	3	7	80
3	FRC 127E	5	10	5	7	100
4	FRC 129A	5	30	1	7	100
5	FRC 129A	5	30	3	7	100
6	FRC 131A	5	30	7	10	80

Suckling Rats. The suckling rat about a day old was placed in a transparent quartz tube perpendicularly, the ventral surface facing directly the source of the radiation, and was supported at a distance of 4 inches from the mercury arc. The method of tumor inoculation was identical with the preceding technique, except that in the case of suckling rats we employed a small trocar having a diameter of approximately 1.75 mm. The results are summarized in Table V.

TABLE V

RESULTS OF TRANSPLANTING FLEXNER-JOBLING RAT CARCINOMA IN SUCKLING RATS AFTER EXPOSURE TO ULTRAVIOLET RADIATION

Exp. No.	Tumor Tissue Used	No. of Rats Irradiated	Duration of Daily Exposure in Min.	No. of Exposures	Time Elapsed in Days between First Irradiation and Inoculation	Percentage of Tumor Takes
1	FRC 128A	5	5	1	3	80
2	FRC 126D	4	5	1	6	100
3	FRC 126D	6	5	1	10	100
4	FRC 129C	3	3	3	7	67
5	FRC 126C	5	1	5	7	80
6	FRC 128A	7	1	7	10	71

Mice. The mouse was fastened to a board, the ventral surface facing directly the source of the radiation and treated at a distance of 4 inches. During the irradiation the face of the animal was protected from the radiation by a thin sheet of paper. Results obtained from this experiment are given in Table VI.

TABLE VI

RESULTS OF TRANSPLANTING BASHFORD MOUSE CARCINOMA IN MICE AFTER EXPOSURE TO ULTRAVIOLET RADIATION

Exp. No.	Tumor Tissue Used	No. of Mice Irradiated	Duration of Daily Exposure in Min.	No. of Exposures	Time Elapsed in Days between First Irradiation and Inoculation	Percentage of Tumor Takes
1	63 243A	10	7	5	8	100
2	63 243A	5	7	1	4	80
3	63 241A	7	5	7	10	71
4	63 241A	5	5	1	10	100
5	63 243B	5	1	10	10	80

The three preceding experiments were conducted with various doses of radiation ranging from a lethal to a suberythema dose producing no visible effects upon the animals, so that the absorbed radiation might induce resistance of the animals to transplanted cancer. The results of the three above experiments indicate clearly

that the degree of resistance, as shown by the percentage of positive inoculations was not altered by irradiation of the animals with ultraviolet light. Present results support our previous findings[14] with oral administraton of cod-liver oil, linseed oil, and olive oil in that the increased assimilation and retention of calcium and phosphorus in the animal does not play a rôle in cancer resistance.

SUMMARY

Because of the questionable effects of sunlight on the malignancy of transplanted tumor of the rat, studies were made on the effects of ultraviolet radiation emitted from a quartz mercury arc lamp upon tumor susceptibility and growth in albino rats and mice.

In vitro experiments indicate that the proliferating capacity of Flexner-Jobling rat carcinoma was stopped by the radiation in comparatively short exposures. This destructive action appears to be due to the selective absorption of the radiation by the cancer cells.

The results of irradiation of a malignant mass at a depth in the animal body by ultraviolet radiation applied externally may be summarized as follows: (*a*) The development of small tumors is checked by severe doses; (*b*) there is an increased rate of growth of malignant tumors after inadequate irradiation of small tumors, and (*c*) large tumors are seldom beneficially affected by the radiation.

Radiation from a quartz mercury arc lamp does not confer resistance upon rats and mice to transplanted cancer.

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ROENTGEN RAYS, INDUCED STERILITY, AND THE PRODUCTION OF GENETIC MODIFICATIONS

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THE question of the production or induction of heritable modifications by artificial treatment of adult animals has been recently brought again to the foreground of experimental biology. For years it has been the hope of biologists to bring about such modifications, but the hope has grown dimmer, and the possibility more remote as the years have progressed. It is generally conceded that an effect induced in an adult animal by artificial means cannot be transmitted to the offspring, although sporadic claims to the contrary are perennially forthcoming, only to be disproven or dismissed for lack of evidence.

Somewhat different, and more plausible, are the claims of the possibility of inducing heritable modifications by direct effect on the germ cells or the developing embryos. Alcohol and other chemicals, sensitized sera, heat, cold, radium and roentgen rays, among other things, have been used. In such cases, the treated adult animals may themselves remain unaffected. The investigator may thus absolve himself from the necessity of presenting his results as an instance of "the inheritance of acquired characters."

Results from experiments of this nature have been conflicting. Some positive results have been obtained, and an equally large volume of negative results. Defective offspring in one or another of later generations from treated animals have been obtained by Stockard and Papanicolaou (1918) in guinea pigs treated with alcohol, by Guyer and Smith (1918, 1920, 1924) in rabbits treated with sensitized serum, by Mavor (1922, 1923, 1924) in *Drosophila* treated with roentgen rays, by Hanson (1924) in rats treated with roentgen rays, by Bagg (1922) in rats and other animals treated with radium, by Little and Bagg (1923, 1924) in mice treated with roentgen rays, and by others. Only in the case of Guyer and Smith's rabbits and Little and Bagg's mice is any conclusive evidence presented of the hereditary transmission of an actual modification induced by the treatment.

On the other hand, negative results have been reported by Huxley and Carr-Saunders (1924) in a repetition of the work of Guyer and Smith, by Finlay (1924) in experiments somewhat similar to Guyer's, using rats and mice, by Mann (1923) in *Drosophila* treated with heat, cold, gasses and a variety of chemicals, by Loeb and Bancroft (1911) in *Drosophila* treated with radium and other agents, and by others. Also, the experiments with alcohol conducted by Pearl, Danforth, MacDowell, Hanson, Nice, Bluhm, and Bilski on various animals have failed to produce defective offspring like those obtained by Stockard in guinea pigs (cf. Pearl, 1924), although the slight reduction in ability to learn noted by MacDowell and Vicari in the offspring of alcoholized rats may be a hereditary modification.

This paper is a report of experiments with rats treated with roentgen rays for the purpose of trying to induce heritable modifications. A preliminary report has already been published (Snyder, 1925). The experiments were started at the Bussey Institution of Harvard University, under the direction of Dr. Castle, and were continued at the North Carolina State College.

Only male rats were exposed to the roentgen rays. The object was to irradiate the germ cells and as little else as possible. Therefore, only the region of the testes received the rays. This was accomplished by fastening the rat to a sliding wooden door which fitted into a wooden box sheathed with lead 2 mm. in thickness. When the rat was in position the scrotum came exactly opposite an oval opening in the lead sheathing. In this way the whole body of the rat, except the scrotum and the parts immediately overlying it, was protected from the rays.

More than 50 adult male rats were exposed to the roentgen rays. They were all about four months old at the time of raying. Since sexual maturity is reached at about three months, and the rats may remain sexually active for a year or more afterwards, these rats were about at the beginning of their sexually active life.

The rats were irradiated for varying lengths of time, after being etherized and strapped to the door. The voltage and amperage, arbitrarily selected for their convenience, were kept constant, as was the distance from the tube to the rat. These relations were as follows: 65,000 volts, 10 ma., 40 cm. distance. The time of exposure alone was varied, thus giving various dosages. A Coolidge tube, tungsten target, was used.

To start the experiment, rats were exposed to the rays for periods varying from one minute to an hour and a half. Each exposed male was tested for fertility by keeping it constantly associated with fertile females, alternating it every three weeks between two cages of females, to further insure a valid test of its fertility.

At first an aluminum filter was used. Rats irradiated up to an hour with this filter remained fertile, regularly producing normal, healthy litters. The use of the filter was then discontinued. Rats irradiated up to thirty-five minutes in this way were normally fertile, but those irradiated for forty minutes went through a sterility period, after which they were again fertile. It is to be noted that when the filter was used, no sterility occurred. This indicates that the soft rays, of long wave length, were the effective rays in causing the sterility period.

The rats which went through the sterility period (those which were irradiated for forty minutes without a filter) are the ones concerned in the rest of the experiments. They behaved as follows: For the first few weeks after treatment they were normally fertile. Litters were produced as long as sixty-six days after the exposure. The average time at which the last litter before the sterility period was produced is forty-five days. After this period of fertility, a sterility period set in, during which no young at all were produced. The average sterility period was about three months. After this sterility period, which varied in duration among the individual rats, full fertility again appeared and large healthy litters were regularly produced. The data on the sterility periods are summarized in Table 1. Hooker (1922) also reports securing temporary sterility in male rats by the use of roentgen rays.

TABLE 1

Rat No.	Litters Produced after Irradiation and before Sterility	Av. Young per Litter	Time from Irradiation until Last Litter Produced before Sterility, Days	Time from Irradiation until First Litter Produced after Sterility, Days	Sterile Interval, Days
10	6	6.5	55	120	65
66	6	5.6	66	110	44
167	3	6.3	62	146	84
182	*	*	*	136	*
185	1	5.0	24	156	132
186	4	6.0	51	**	**
215	3	5.7	65	119	54
217	3	4.3	43	***	***
218	4	7.0	50	259	209
219	2	4.5	47	**	**
227	2	7.5	27	150	123
229	*	*	*	146	*
231	3	4.3	49	141	92
234	4	5.5	58	***	***
330	1	8.0	33	275	242
536	1	8.0	29	***	***
541	1	7.0	29	***	***
564	2	6.0	27	***	***
Average	..	....	44.7	159.8	116.1

* Kept from females until 75th day.
** Died before regaining fertility.
*** Killed for histological sectioning.

It is presumed that the litters produced before the sterility period are from sperm which were mature at the time of irradiation. If this is so, perhaps we have here a clue to the length of time mature sperm can live in the testis and epididymis. Since the gestation period in the rat is twenty-one days, functional sperm must have been present in some cases as long as forty-five days after irradiation. If a rat which has received this dosage is kept from females until about the seventy-fifth day, which is in the midst of the expected sterility period, the rat is found to be sterile upon being placed with females. Thus functional sperm are lacking at the expected time of sterility whether the rat has been sexually active or not following the treatment.

When the exposure was increased to sixty minutes, the rats went through the same process, except that they frequently failed to become again fertile after once becoming sterile. Increasing the dosage to

eighty minutes eliminated even the mature sperm, so that the rat was fully sterile immediately following the exposure.

Obviously all of the offspring produced by the irradiated rats could not be raised and inbred due to lack of facilities. The first litter produced by a male after his sterility period was considered as the critical litter, since it was presumably produced from germ cells which just escaped being rendered nonfunctional, and might conceivably be affected in some way. Therefore, this litter in each case was saved and inbred by brother-to-sister matings, for subsequent generations. Also back-crosses within the individual lines were made, and various crosses between these irradiated lines.

A total of 1024 individuals has been raised from these litters. Of these, 870 are the direct inbred descendents of the irradiated males, and 154 are from crosses between the various irradiated lines. The sixth filial generation has now been reached, with no sign of abnormality of any kind, no apparent reduction in vigor, and no decrease in fertility. Large healthy normal litters are regularly produced by the descendents of these first litters after sterility. The only positive result is the sterility period itself. This corroborates the fact already known that roentgen rays affect actively growing tissue more than quiescent tissue. The mature spermatozoa as well as the very early stages of the germ cells resisted the effects of the rays, while the intervening developmental stages were susceptible. Histological sections of testes during the sterility period failed to show any active stages of spermatogenesis.

These results have some bearing on the therapeutic use of roentgen rays. Little and Bagg (1923) from the results of their studies in mice, suggest extreme caution in the use of roentgen rays for medical purposes. For purposes of temporary sterilization, the use of roentgen rays seems to them a tremendous risk. Pemberton (1924) has summarized the available data on child-bearing in women after irradiation, and finds that normal children are born from pregnancies subsequent to treatment. Of course only the first generation is available as yet in these cases. It would be well if hospitals could keep records of further generations from children born under such conditions. According to Pemberton, an ovum damaged by irradiation is not capable of fertilization, or if it ever is fertilized, comes away by miscarriage. There are no reports of abnormal children resulting from the irradiation of nonpregnant women, or of men. However, irradiation of pregnant women may result in poorly developed or deformed children.

Certainly in the case of rats, temporary sterility in the males can be easily induced without any apparent deleterious effects either on themselves or on the subsequent progeny.

The production or induction of heritable modifications by artificial treatment is not yet an established fact. The large and ever-growing body of negative evidence indicates that it cannot be done at will. In the case of the few experiments which have pointed to heritable effects of treatment of one kind or another, repetitions of the work, where attempted, have so far failed to give the same results. These experiments should be very carefully repeated with known stock and definite controls before any far-reaching conclusions are drawn.

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ROENTGEN-RAY TREATMENT OF CHRONIC COUGH IN CHILDREN*

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THE title of this paper aside from its ambiguity is somewhat misleading, but inasmuch as emphasis is placed upon a certain type of cases in which cough is the predominating, and in many instances, the sole symptom, I have chosen the aforesaid title.

In 1903, Heinike first published the results of his experimental work on the effects of roentgen radiation on lymphoid cells and structures, proving definitely the retrogressive and destructive action induced by roentgen exposure on glandular tissue. Clinical application of Heinike's classical studies have amply supported and further elaborated these findings, and the regression in adenitis, Hodgkin's disease, splenic enlargements, Basedow's disease, and other pathological conditions of lymphoidal structures are but outgrowths of these experimental studies of nearly a quarter of a century ago.

Preliminary to passing on to the main purport of this paper, a brief presentation of some of the major intrathoracic conditions in children amenable to roentgen treatment might not be out of place.

First, thymic enlargement is a condition which bears the brunt of possibly more wrongful and unwarranted diagnoses than any other pathological condition encountered in the newborn. The name itself is a misnomer, as a shadow of a thymus measuring 3 cm. or more is present in 42 per cent of normal infants presenting symptoms or evidence of thymic disease. An enlarged thymus is no more evidence of disease than enlarged thyroid is evidence of Grave's disease. It is only when the gland is so large or in such position that it mechanically causes pressure or obstructive symptoms that it produces a condition calling for treatment. A far better term for this condition is thymic hyperfunction— or dysfunction—a clinical entity comparable to hyperthyroidism. As thyrotoxicosis with all the clinical phenomena of Graves' disease can exist without an evident enlargement of the thyroid, so can symptoms of thymic asthma be present without roentgenologic evidence of an enlarged thymus gland. True, it is only the broad thymus that casts a discernible shadow, yet one quarter of all thymus glands that are enlarged are of the elongated or pedicle type and show no roentgen evidence of their presence, their shadow being obscured by the sternum, vertebrae, and great vessels.

If there is one real specific in pediatric medicine, I feel that it is the radiation treatment of thymic disease. The relief afforded sometimes by only one exposure is so marked that it verges on the dramatic. In a number of instances I have seen infants practically *in extremis* with stridor,

* Read at the meeting of the Southeast Branch Philadelphia County Medical Society, May 7, 1925.

dyspnea, and tetany, react miraculously within a few hours after a single roentgen treatment. The reduction in size of the enlarged thymus gland can be simultaneously followed by roentgenographic study.

In cases of true thymic hyperfunction, without concurrent enlargement of the gland itself, the relief can be ascribed to the depressant influence of the roentgen rays on the glandular secretion. In fact Friedlander of Cincinnati, who claims to have treated the first case of thymic disease by roentgen rays in 1907, with entire cure, insists that "if symptoms of thymic asthma are present, even though the *x*-ray showed no shadow of the thymus, nevertheless, radiation should be given." And to the converse of this, Freeman reports symptomatic relief from the roentgen ray even though the size of the shadow did not diminish. Both of these apparently paradoxical findings are explainable on the basis of the diminution of glandular activity as a result of the roentgen treatment.

Two conclusions might be stated as almost axiomatic: (1) That failure of symptomatic relief suggests an error in diagnosis, and (2) the effects of properly measured roentgen dosage on the thymus appears so definite that it might be applied as a diagnostic procedure in doubtful cases, much as the therapeutic test is employed in suspected syphilitic conditions.

Status lymphaticus, a condition practically always associated with thymic disease (Symmers of Bellevue, in necropsy of 118 cases of status lymphaticus found the thymus gland to be present and enlarged in every case), shows marked amelioration and concurrent glandular resolution at a site remote from the thymus, when roentgen exposure is given to that gland alone.

The rather infrequent and invariably fatal thymic apoplexy does not respond to roentgen therapy.

A group of cases presenting a dissimilar pathology, but clinically and etiologically very much alike, are mediastinitis, peribronchial adenitis, and hilusitis. Holt gives a classical description of the symptomatology of inflammation of the bronchial lymph nodes. "Cough is hoarse, persistent, teasing and frequently occurs in paroxysms which resemble pertussis but lacks the whoop and is not accompanied by the expectoration of a mass of tenacious mucus. Paroxysms are severe and often prolonged. The dyspnoea is paroxysmal, and may resemble spasmodic cough or even severe asthma." Holt differs from many observers in stating that bronchial gland enlargement is usually due to tuberculosis.

This group of cases is usually amenable to roentgen treatment. Their response to radiation and technique of application so parallels the next class to be considered, the presentation of which is the principal motive actuating the writing of this paper, that I shall defer consideration of these factors, or rather group them with the cases which are now to be considered.

Empiricism is so contrary to modern scientific medicine that any therapeutic measure advanced at the present day not based upon experimental and laboratory research and data, must perforce lose much of its value. And yet clinical medicine has struggled through the ages and given birth to its most valuable healing agents purely upon empirical grounds. Assayed in the molten crucible of experience and withstanding every conceivable onslaught of criticism and trial, there have survived many of the most valuable therapeutic aids in medicine based upon what is the true and tried test—the result achieved in the war against disease at the patient's bedside. This is merely by way of preface in suggesting a therapeutic measure which is by no means original nor new, yet is based largely upon purely empirical grounds for its retention as a remedial ally in disease.

One of the real difficulties besetting the path of those whose practice is among children, is the treatment of chronic persistent cough—often a symptom without any evident underlying pathology. It is by no means an uncommon condition and constitutes a class of cases trying the physician's skill, diagnostic acumen and patience. The entire therapeutic gamut is run, the resources of the materia medica are exhausted and despite this the harassing cough continues. Of course, there

have been eliminated the usual etiologic factors producing a chronic cough. Enlarged or diseased tonsils or adenoids, pulmonary tuberculosis, unresolved pneumonia, cardiac disease, pleuritic effusion, empyema, and bronchial asthma, have been either excluded or proper methods to the relief of these conditions instituted.

Atypical whooping cough, particularly prevalent in infants, and very young children must not be overlooked. Several children referred to me for roentgen treatment were later discovered to have had this disease, and yet if the researches of Leonard and Bowditch of Boston, who have given roentgen treatments to several hundred sufferers from pertussis, and whose results are being duplicated by other roentgenologists, can be relied upon, then the roentgen ray is a most valuable means of checking and alleviating the paroxysms of this disease. My work in this field has not been conducted with a sufficiently large enough group of cases for me to be able to report conclusive results. The class of children in which roentgen radiation seems of distinct therapeutic service may be summarized clinically as follows: The children are from two to nine years of age—rarely older—and in only an occasional instance younger: they are usually healthy looking, well nourished and without any distinctive physical signs in the chest. Occasionally a few râles may be heard, but usually auscultation and percussion yield no information of any detectable intrathoracic pathology. And yet in all the cases there is a history of long-standing cough, very often harassing and persisting even during sleep. The cough is in most instances nonproductive. Occasionally some glairy mucus is expelled. Some attacks are paroxysmal in character and may simulate bronchial asthma from which it can usually be differentiated by the lack of dyspnea, the accompanying breast heaving and rapid respiration. The longer duration—some cases may be of several years duration—will serve to distinguish it from whooping cough.

Roentgenographic study—all cases that have come to me have been examined roentgenologically—presents no typical findings. Although nearly all the cases present a peribronchial fibrosis or some scattered enlarged bronchial or mediastinal lymphnodes, these are such constant findings in practically all children's chests that I do not believe stress should be placed upon their presence in the film. The roentgen ray is chiefly valuable in a negative sense. Having excluded the presence of enlarged thymus, tuberculosis, pleuritic fluid or adhesions, and particularly a foreign body in the bronchi, the presence of a typical pathological picture associated with this group of cases from a roentgenologic viewpoint can be disregarded.

Clinically, these children more closely resemble a nonproductive chronic bronchitis than any other clinical entity.

The results from roentgen therapy have proven highly gratifying. Complete cessation of the cough is obtained in practically every instance. While I have had a number of these patients in years past, it is only within the past eight months that a detailed record was kept of the cases. During this period 22 children were treated by roentgen radiation for this idiopathic cough. Twenty were entirely relieved in from 2 to 5 exposures. In only 2 was no relief afforded. Treatments were given in a subintensive dose weekly or at ten-day intervals. In two instances the cough subsided within forty-eight hours after first treatment, and there has been no recurrence.

To explain the *modus operandi* of radiation in clearing up these so-called idiopathic coughs in children would be pure theorizing. Whether a thymic influence keeps up the irritation or the presence of one or more bronchial lymph glands so situated as to cause pressure on the vagus or its branches is problematical. In either or both instances the effects of the roentgen ray is explainable on the hypothesis of the influence of radiation on lymphoid tissue. Whatever the cause, the results have been sufficiently encouraging to warrant the continued use of roentgen radiation in this class of patients.

AN EXPERIMENTAL STUDY OF THE MARKINGS SEEN IN ROENTGENOGRAMS OF THE LUNGS OF NORMAL DOGS*

BY W. JAMES MARQUIS, M.D.

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ROCHESTER, MINNESOTA

As early as 1899, Crane,[1] writing on the cause of the increased density observed in the lung on expiration, said there must be an increased quantity of blood and lymph in the lungs. Hickey,[2] five years later, concluded from experimental work on the lungs of dogs and from studies of lungs removed at necropsy, that in normal lungs the ramifying shadows seen in pulmonary roentgenograms were caused chiefly by the pulmonary vessels. Since this time many studies have been made on the lungs of man, either by making roentgenograms of lungs removed at necropsy with subsequent anatomic studies, or by comparison of the roentgenograms with the clinical findings.

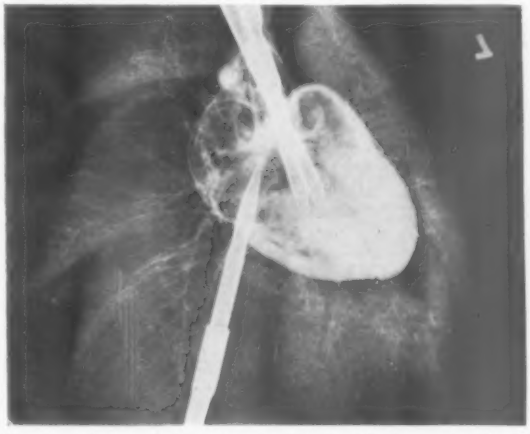

FIG. 1. Lung inflated, vessels washed out and air injected. Note the fine tracery of linear shadows, generally in duplicate. In this preparation there is no way to identify which structures are casting shadows.

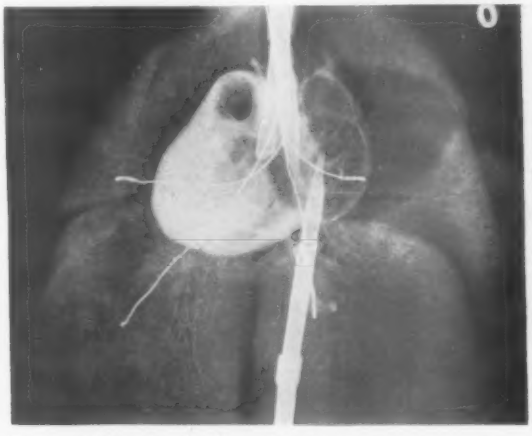

FIG. 2. Wires in the bronchi; the upper two wires do not appear to be inclosed in any shadows. The lower left wire appears to be between two linear shadows for a short distance, but they gradually grow less distinct and cannot be seen at all at the terminal part of the wire. The lower right wire is apparently within shadows but near its terminal part appears to cross one of the linear shadows.

There is little in textbooks on roentgenology of the lungs that pertains to the cause of these markings. Walsh,[3] Barjon,[4] Knox,[5] and Overend[6] do not discuss the subject. Wessler and Jaches[7] assert that the lung fields are traversed by a network of shadows which are produced by the bronchi, blood vessels and lymphatics, and by the small amount of connective tissue around them.

According to Fraenkel and Lorey,[8] Cowl,[9] and Groedel[10] are of the opinion that these shadows are caused by a combination of both vessels and bronchi, but de la Camp,[11] Kraft,[12] and Arnsperger[13] believe that they are caused by the bronchi. Rieder,[14] Albers-Schönberg,[15] Holzknecht,[16] and many others, believe that they are caused mainly by the blood vessels. Fraenkel and Lorey conclude from their summary of the literature that the bronchial arborization does not produce a shadow on the plate. They further conclude that in abnormal conditions, as when the bronchus is filled with pus, it may cast a shadow.[17] Garcin[18] asserts that the shadow is of the vascular tree with its fine network. Assmann,[19] after extensive experimental and postmortem

*Work done under the direction of Dr. H. E. Robertson, Division of Pathologic Anatomy.

studies, summarizes his conclusions as follows: "The normal lung picture is produced by summatory action, the blood-filled vessels constituting the most important factor, showing on the plate as solid shadow cords and spots, the lumina of the main bronchi as clear spaces, the orthoroentgenograde bronchi as ring shadows, the walls of the greater bronchial branches having a slight strengthening influence on other shadows. The influence of the lymphatics on the roentgenogram is not usually of much significance except in pathologic conditions."

Assmann's experimental work was done on dogs. He ligated the veins and arteries of living animals on one side, in the elastic filling state, then killed them, removed the lungs, carefully rinsed the vessels of the other side and insufflated the lungs. The roentgenograms then showed very strikingly the difference between the plethoric and the empty lungs; the former contained thick solid ramifying shadows while the latter contained only delicate tracing, generally with duplicate contours. This observation indicated without a doubt that the blood-filled vessels produce a great part of the tracing of the normal lung, but he further asserts that the effect of the bronchial system cannot be determined with equal certainty, because it cannot be eliminated from the lung.

Although the bronchial system cannot be removed from the lungs as can the blood, the shadow-producing effect of the bronchial walls can be compared with that of the walls of the vessel. To do this, conditions in both systems must be exactly similar, and yet the systems must be marked so that they can be identified. I accomplished this by washing out the vessels with physiologic sodium chlorid solution and then injecting air. The shadow-producing effect of the blood was thereby eliminated and, by appropriate markers for identification, the shadows produced by the walls of the vessels could be compared with those produced by the walls of the bronchi. By reinjecting blood into the vessels the rather marked absorption of the roentgen rays by the blood could be nicely demonstrated.

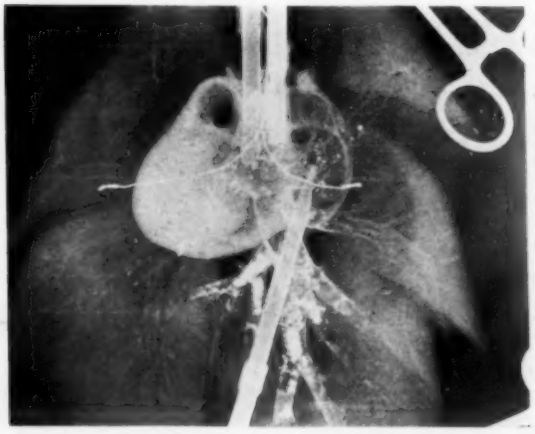

FIG. 3. Dry barium sulphate has been blown into the bronchi through the trachea (the two lower wires have been withdrawn). In only a few instances can shadows be seen extending as a continuation of the barium sulphate, and in a stereoroentgenogram these shadows are in a different plane.

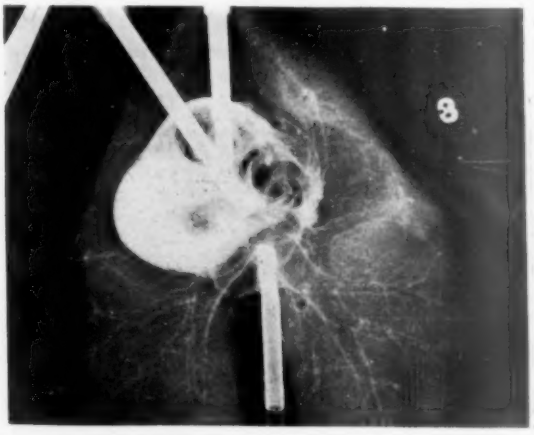

FIG. 4. Lung inflated, vessels washed free of blood, and air injected as in Figure 1. Note the absence of solid ramifying shadows.

Under ether anesthesia, the abdomen of the dog was first opened, the inferior vena cava exposed and ligated, and a cannula inserted proximal to the point of ligation. A bottle containing physiologic sodium chlorid solution was connected to this cannula by rubber tubing and the solution allowed to enter the vessel by either air pressure or gravity. The thorax was then opened and the superior vena cava quickly clamped and the aorta severed. The heart would usually continue

to beat until the lungs had been completely washed out and the flow from the aorta was clear. Care was taken not to inject the sodium chlorid solution so rapidly as to rupture the small venules and arterioles. In this way practically all the blood could be removed from the vessels of the lungs. The lungs, heart and immediate vessels were then removed and as much of the sodium chlorid solution as possible allowed to drain from the vessels. The circuit of the pulmonary vessels was intact, and they could be inflated through both the inferior vena cava and the aorta. If any fluid remained in the vessels, it would usually be evident in the large vessels near the surface, and by deflating and inflating several times, could usually be eliminated.

Roentgenograms of the deflated lung with air in the vessels contained ramifying areas of decreased density which extended to the periphery and tapered evenly. Roentgenograms of the inflated lung with air in the vessels showed only fine delicate linear shadows (Fig. 1), which usually appeared to be in duplicate. In order to determine whether these shadows were caused by the walls of the bronchi, or the vessels, or both, wires were inserted into the bronchi. On careful examination of both flat plates and stereoroentgenograms, it was found that the wires were within areas of increased radiability which appeared only at the hilus and against the relatively dense shadow of the heart (Fig. 2). As the periphery of the pulmonary field was approached, these areas became less distinct and only for a short distance from the hilus could parallel linear shadows be made out on either side of the wires. The terminal parts of the wires appeared to be in the parenchyma of the lung, but after their withdrawal, since the lung could still be inflated and subsequent dissection showed no rupture, it was evident that they had been entirely within the bronchi. The terminal parts of the wires could also be seen to pass apparently across the more prominent linear shadows, and in the stereoscopic examination the wires were seen to be in a slightly different plane from these linear shadows. Dry barium sulphate was then blown into the bronchi, thus outlining their inner surfaces (Fig. 3). Now the wires could be seen to be enclosed by the shadows produced by the barium sulphate, and in the stereoscopic examination the bronchi, as outlined by the barium, appeared to be in a different plane from the fine linear shadows. The barium could not be blown into the terminal bronchi, and it was noted that the fine narrow shadows were not continuous with projections from the edges of the shadows of the barium sulphate.

Roentgenograms of inflated lungs, after citrated blood had been reinjected into the blood vessels, showed the solid heavy ramifying shadows that are seen in roentgenograms of the lungs of man (Figs. 4 and 5).

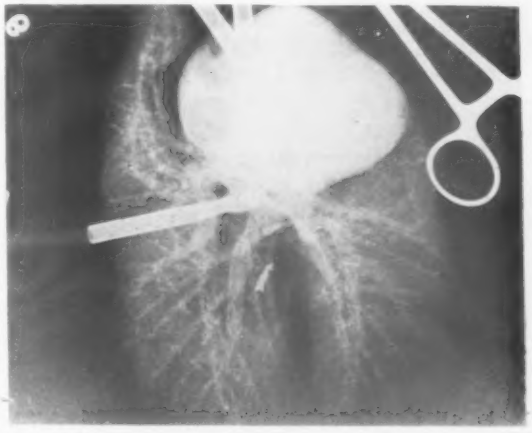

FIG. 5. Lung inflated, vessels reinjected with citrated blood. Note the reappearance of the solid ramifying shadows radiating out from the hilus. This is the character of the shadows as seen in the usual pulmonary roentgenogram.

COMMENT

The most striking effect produced by removing the blood from the vessels of the lung is to change the roentgenographic markings from the usual broad solid ramifying shadows of decreased penetration to fine, delicate, narrow or linear shadows that usually appear in duplicate. It was obvious in this experiment that these fine linear shadows must be caused by some of the structures that make up the walls of the vessels and the bronchi. After the insertion of wires into the bronchi, the course of the lumen could

be demonstrated in the roentgenogram and a comparison made with the linear shadows. Since the wires were seen to be in a different plane, and since the linear shadows did not inclose the wires except at the hilus and medial part of the lung field, it can be assumed that the bronchial walls do not cast a shadow in the roentgenogram. This was corroborated by the fact that when dry barium sulphate had been blown into the bronchi and their inner surfaces thereby outlined in their proximal extent, no shadow could be demonstrated beyond the shadow of the barium sulphate which would correspond to a continuation of it. After citrated blood had been reinjected into the vessels of a lung from which the blood had been removed, roentgenograms showed the reappearance of the heavy solid ramifying shadows that appear in the usual roentgenogram of the lungs. These studies, therefore, demonstrate not only the important part the blood-filled vessels play in the production of the markings seen in roentgenograms of the lungs of normal dogs, but also the relatively small part bronchial walls play in their production.

CONCLUSIONS

1. In the lungs of normal dogs the walls of the main bronchi at the hilus only may cast a shadow in a roentgenogram.

2. The bronchial walls in the outer portions of the pulmonary fields do not cause a shadow.

3. In roentgenograms of the lungs of normal dogs the broad solid ramifying shadows seen radiating out from the hilus are caused in the main by the walls of the vessels and the blood they contain.

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AN UNUSUAL METASTATIC MANIFESTATION OF HODGKIN'S GRANULOMA

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BECAUSE of the rarity of involvement of the spine, that is, a true involvement *per se* and not erosion by pressure of enlarged retroperitoneal or mediastinal glandular masses, we felt that a report of our case would be of especial interest. The literature cites only a few previous examples, the latest being from the *Bull. et Mem. Soc. méd. hôp. de Par.*, by Louste, Thibaut and Valière-Vialeix, who report a Hodgkin's case showing lesions of the vertebrae and sternum. Pfahler reported a case, in the AMERICAN JOURNAL OF ROENTGENOLOGY AND RADIUM THERAPY, May, 1924, of disease of the sacroiliac joint in a proven Hodgkin's disease, and in the discussion of this case Herendeen reported that he had seen one case of true spinal involvement at the Memorial Hospital.

Our case was in a man, aged thirty-one, who came to the Radiotherapy Department of Mount Sinai Hospital in July, 1924. He presented the typical clinical picture of generalized Hodgkin's disease with swelling of the neck for the past eight months, headaches for five months, and general abdominal pain for five months, increasing in severity and sticking in character. He had chills and fever of the Pel-Ebstein (Murchison) type and anorexia with loss of weight (present weight 124 lb.). On examination there were found generalized bilateral masses in the neck, axillary, retroperitoneal and inguinal regions. The spleen extended several fingers below the left costal margin. Mediastinal dullness, 10.5 cm. in width. Blood Count: Hg. 60 per cent; R.B.C., 4,000,000; W.B.C., 13,250; neutrophiles, 79 per cent; lymphocytes, 20 per cent, monocytes, 1 per cent.

Roentgen examination of the chest showed the following: In the superior mediastinum there was a large tumor mass extending beyond the paratracheal line on both sides; its borders were lobulated.

The pathological report from an excised gland from the left side of the neck was Hodgkin's disease.

The patient received during the period of one month, over the left axilla, anterior and posterior chest, and right and left inguinal regions, a number of fractional doses of high voltage therapy totalling up to a full erythema dose per area. In two and a half months he was symptom free. The hemoglobin went up to 100 per cent and weight to 144 lb. W.B.C. became normal. Subjectively the patient felt well.

FIG. 1. Involvement of the spine in Hodgkin's disease.

Several weeks later he developed pain in the lumbar region. No other signs except this pain were present. Roentgenograms

of the spine were taken and the report was: Partial collapse of the seventh dorsal and first lumbar vertebrae. The appearance is not characteristic either of malignancy or tuberculous spondylitis (Figs. 1 and 2). Later roentgenograms

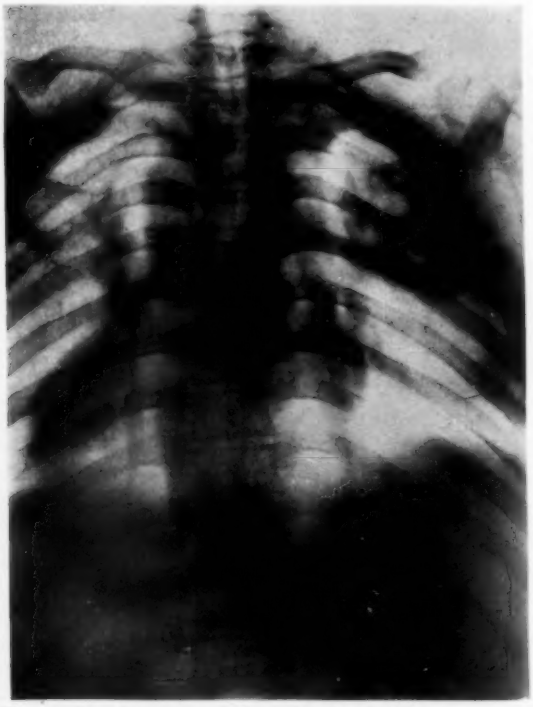

FIG. 2. Involvement of the spine in Hodgkin's disease.

showed a similar process in the right ilium at the crest and in the left ilium near the sacroiliac synchondroses.

In view of our clinical findings a diagnosis of Hodgkin's disease of the spine was made, but all effort was made to rule out any of the likely invaders of the spinal column. On examination of the patient, there was no evidence of primary malignancy. Then, too, the appearance of the roentgenograms did not correspond to the appearance of either of the two types of metastatic carcinoma. The hyperplastic type, usually primary in the prostate, gives bone condensation with marked increase in the density of the involved portion without collapse of the vertebrae. The second type—the destructive metastatic carcinoma (as from a primary breast lesion) gives a much more marked bone absorption with a ragged moth-eaten appearance, but without collapse of the bodies of the vertebrae. Tuberculosis of the vertebrae when as advanced as the condition seen in Figures 1 and 2, would have involved the body of the vertebra above and that of the one below. Thus comparing the pictures that are shown with the possibilities, and weighing in addition the clinical evidence a fairly certain estimate of the case can be made.

Ewing in his book on Neoplastic Diseases (p. 371) says that Hodgkin's granuloma can occur anywhere and that bone lesions are often seen. The bone marrow is involved and by intrinsic pressure the cortex is destroyed. This would correspond to the picture in this case.

At the present time the patient is under treatment for the spinal lesions and although he is markedly improved clinically, there is very slight change in the appearance of the roentgenograms. As new glandular enlargements occur they are treated.

I am indebted to Dr. Jaches, roentgenologist, and to Dr. Stern, radiotherapist, for permission and assistance in publishing this case.

THE TREATMENT OF BONE SARCOMA BY TOXINS, RADIATIONS, AMPUTATION OR RESECTION*

BY JOSEPH C. BLOODGOOD, M.D.

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DR. COLEY should always be given credit for his perseverance in continuing the employment of toxins in sarcoma.

For more than twenty-five years I have attempted in every way to compare the results in my own collection of cases with those reported by Dr. Coley and we have had an opportunity, thanks to Dr. Codman, for a restudy of all the apparently cured cases of sarcoma of bone.

The first question to answer is: Has the toxin alone accomplished a cure without amputation or resection? It seems to be the opinion of the registration committee that there is only one case in all these years in which the cure may possibly be credited to the toxins alone.

Second: Is there a larger percentage of five-year cures in the cases of sarcoma of bone in which, in addition to resection or amputation, the toxins have been employed?

This is a very difficult question to answer because there is always the possibility that lesions of bone not sarcoma have been included. The registration of cured cases has proved that a large percentage of reported five-year cures of bone sarcoma by any method of treatment, when submitted to a committee of pathologists, were not sarcoma.

Taking the conclusions of Codman's registration committee as correct, there is no doubt that a certain percentage of sarcoma of bone have remained free from recurrence five years or more, but there is no evidence in the registered cases that the extra-treatment with toxins has accomplished any larger percentage of permanent cures.

The failure to cure in sarcoma of bone and, in fact, in sarcoma anywhere is not so much due to the local recurrence as to metastasis to the lungs. I have always hoped that the study of the very large group of cases in which the toxins had been employed, would suggest that the toxins protected from death from metastasis. But I am not able to find this evidence. The same is true of roentgen rays and radium. Although we have observed some very remarkable effects upon the local growth, I know of but one case in which the shadow of the metastatic growth in the lung as pictured in the roentgenogram disappeared under roentgen treatment.

As far as my observations go, there is little to expect from toxins, roentgen rays or radium as a protection against lung metastasis in sarcoma of bone, or as a treatment for metastasis after it has become evident.

Of the many cases of sarcoma of bone subjected to roentgen-ray and radium treatment alone, I have but one example in which the evidence favors a definite cure. The tumor involved the upper shaft of the humerus. The roentgenographic appearance is of a type that I have never seen except when associated with sarcoma. This patient received intensive radiation by radium; the definitely palpable periosteal tumor disappeared; the patient is clinically well almost five years after the first treatment.

When toxins are employed alone and when roentgen rays and radium are the therapeutic agents, and no tissue is removed, there is aways an element—and a large one—of error that the condition diagnosed clinically and roentgenographically as sarcoma, is not sarcoma, and my records show many examples of bone lesions subjected to the above treatment in which the final microscopic diagnosis excluded sarcoma.

In the past four years, since I made my report in the *Journal of Radiology* for November 1921, a larger number of verified sarcomas of bone treated by amputation or resection has approached or passed the five-year limit and the patients are still free of evidence of metastasis.

From a continuous study this is the only evidence that offers any hope of increasing

*A discussion of Dr. William B. Coley's paper before the American Surgical Association.

the number of cures of sarcoma of bone. The education of the public on immediate examination after the first symptom, the careful study of the case, and if it is sarcoma, amputation or resection should be the operation of choice. Roentgen rays and radium should be reserved for lesions where resections cannot be done and leave a limb with good function, and where amputation up to the present time has never accomplished a cure.

If the sarcoma is situated on a bone of the lower extemity below the middle third of the femur, amputation is the operation of choice, if resection cannot be done and leave a limb of better function than an artificial limb. Up to the present time all our cured cases are situated below the middle third of the femur.

In the upper extremity there is not an authentic cure by amputation. But as a rule, in the past, the lesions have come under observation at a time when the local growth was so extensive that resection could not be done. In the upper extremity and in the lower extremity above the middle third of the femur, if resection can not be done, it is my practice to employ roentgen rays without exploratory incision. If resection can be done, it has been the the operation of choice.

At the present time I have one patient apparently well almost five years since treatment in which the periosteal tumor involved the upper part of the shaft of the humerus, and the treatment was radium—I have mentioned this case above. A second case, approaching three years and apparently well, was observed so early after the onset that we were able to resect the lower end of the humerus and some three weeks later filled the gap with a transplant. The function of the arm is unusually good, especially in the fingers and forearm. Within the past three weeks I have been able to resect a second early periosteal sarcoma of the lower end of the humerus.

Even if we accept the figures given us by Coley in which the treatment was amputation and toxins, the chances of curing a sarcoma of bone are so small that before any mutilating operation is performed, every effort should be made to establish a correct diagnosis.

The earlier a roentgenogram is taken of a bone after an injury or after any symptom or sign which attracts the patient's attention to the bone, the greater will be the number of central, periosteal and diffuse lesions of benign character, and the majority of these lesions, if left alone, heal spontaneously. When I first began to study lesions of bone, excluding the common tuberculosis of joints and suppurative osteomyelitis in which there is no difficulty in making the diagnosis, malignant tumors predominated. Today benign lesions predominate. There has practically been a reversal of the figures, and the malignant lesions are in the early stages, when diagnosis is more difficult.

Biopsy. Exploratory Incision. There seems to be as much difference of opinion on exploratory incision for biopsy as there is on the value of toxins and radiation in sarcoma.

After giving this subject careful thought I still adhere to the rule first made that the exploratory incision should only be done in a clinic where there is a team or an individual capable of interpreting the gross picture and the frozen section. In addition the operator must be willing to proceed according to the diagnosis and before the operation must have the consent of the family to resection or amputation if indicated.

If help is desired in an individual case, seek it before, not after, the exploratory incision. Roentgen-ray films can be sent by mail and many opinions can be quickly obtained before the exploratory incision. But to make an exploratory incision simply for diagnosis is unnecessary for the benign, and dangerous for the malignant lesion.

When the lesion is in the upper extremity or above the middle third of the femur and resection with bone transplantation is out of the question, it is best to try roentgen ray or radium without exploratory incision. If the patient survives, there may be no proof that you have cured sarcoma. I have two such cases; one of the scapula which clinically and in the roentgenogram suggested malignancy; the patient is clinically well today with a useful arm, but as there was suppuration with the discharge of a spicule of bone, and as there is anky-

losis of the shoulder-joint, the lesion may have been tuberculosis. Had I selected excision of the scapula, it would have been too much for a benign lesion and we have no evidence as yet that such an operation has ever cured a sarcoma. Many scapulas have been sacrificed for the benign giant-cell tumor, tuberculous osteomyelitis and the non-suppurating sclerosing osteomyelitis. One of the most spectacular observations was that of a brilliant young college student with a lesion involving the upper third of the shaft of the femur. The roentgenogram revealed bone formation and bone destruction—more like sarcoma than osteomyelitis. There was a spindle-shaped palpable mass around the shaft, making resection and bone transplantation out of the question. As I knew of no verified case of a sarcoma cured by hip-joint amputation, roentgen treatment was chosen without radiation. For at least six months there was no evidence of improvement. My associate Dr. Kahn gave the treatments. It was pushed up to the point of almost a burn. Then gradually the soft-part mass disappeared, the areas of bone destruction filled in with new bone, and the mass of periosteal bone formation partially disappeared. Without fever or leucocytosis an abscess ruptured, a spicule of bone was discharged, and the sinus healed. Shall we report this as a cured case of sarcoma? Had we explored this, could we have differentiated in the gross and with the microscope the benign from the malignant lesion? It seems to me there was a greater risk of an unnecessary amputation than the chances of a cure, if the lesion was really sarcoma. I find in my correspondence throughout the country that the majority of surgeons, roentgenologists and pathologists are beginning to appreciate the difficulties of diagnosis and all patients with bone lesions are given most careful consideration, and that exploratory incision for diagnosis only is growing less frequent.

I make the following suggestion: that while the case is being studied the limb and even the patient be kept at rest and the local area be treated with deep roentgentherapy. If the lesion is periosteal, give intravenous salvarsan in spite of a negative Wassermann; in every case take roentgenograms from different angles of the involved bone and a corresponding area of the opposite non-involved bone; and also of the chest and the pelvis. If the Wassermann is negative examine the blood again after the intravenous salvarsan. Examine the urine for Bence-Jones bodies. Make repeated counts of the white cells with a differential count.

Now that patients are coming earlier, our diagnosis, in spite of increased experience, is more difficult. My last three cases illustrate this.

Case I. A boy, aged seventeen, with an indefinite history of injury has a diffuse lesion of the lower part of the shaft of the femur above the condyle. There is periosteal bone formation obscuring the marrow shadow so that the diagnosis between sarcoma and sclerosing osteomyelitis seems impossible. As amputation offered most for sarcoma in this situation and as the parents consented exploratory incision was made. The majority of those who saw the patient and the roentgenogram were inclined to the diagnosis of sarcoma. The moment the new periosteal bone was exposed the benign character of the lesion was revealed; it was almost impossible to get soft tissue for frozen sections. The histological picture was that of inflammation—nothing to suggest sarcoma. The limb was saved and the patient spared the tedious radiations.

Case II. In this case the roentgenogram favored an exostosis, or an ossifying periosteal lesion of benign character. It was a small area just above the condyles of the humerus and could easily be excised. Having obtained consent for resection if the lesion proved to be sarcoma, an exploratory incision was made. The moment the capsule covering the periosteal growth was seen, it suggested the appearance of malignancy; nicked with the knife the narrow zone of soft tissue resting on a deeper zone of ossified tissue was typical of sarcoma, and the frozen section revealed a picture in which there was no difficulty in recognizing sarcoma. The exposed malignant tissue was burned with the electric cautery.

In these two cases, although clinically and in the roentgenogram there was difficulty in recognizing the true nature of the

disease, there was none from the gross and frozen section at the exploratory incision. Without fear of mistake the surgeon could leave the bone in one case and resect it in the other.

Case III. Here, clinically and in the roentgenogram, the diagnosis favored exostosis. But there was an indefinite cloudy shadow over the shaft which indicated that a possible sclerosing diffuse sarcoma with excessive periosteal bone formation had to be kept in mind. The lesion occupied the shaft of the fibula in the upper third. It could easily be resected and the limb saved. While studying the case and making repeated roentgenograms, roentgen treatment was given. Finally I explored—not so much to remove the exostosis, but because I feared the possibility of sarcoma. When we explored the palpable periosteal bone formation, it had the same gross appearance of benignancy as in Case I. The periosteum covering the bone formation was a little thicker than in Case I, but it stripped from the new bone formation almost like normal periosteum. Frozen sections from this periosteum showed no evidence of sarcoma. The exostosis was now chiselled off and examined. It had a cortical-bone surface beneath which was a normal cancellous bone. In one spot in the latter bone there was a cavity the size of a pea in which there was fibrous tissue mixed with fat. Frozen sections from this tissue suggested spindle-cell sarcoma. But under the oil-immersion objective the spindle cells in my opinion had the morphology of fibroblasts and none had more than one nucleus which is common in the sarcoma spindle cell. I made up my mind that if this was sarcoma it was a picture I had never seen before. So I treated the lesion as an exostosis. Complete resection was not done. We have studied this further and are still of the opinion that we are dealing with a benign lesion.

I describe these three cases to illustrate the difficulties of the diagnosis at the exploratory incision, and why each case should be so carefully studied before the operation is undertaken. At operation we must have a working rule as to what to do in case of doubt.

At the present time it is my rule not to amputate if there is any doubt as to malignancy. Resection with bone transplantation can be done. This rule is based upon the fact that in early cases difficult to recognize, the chances are that the lesion is benign, and at the present time the probability of a cure of sarcoma by amputation is too small to justify this procedure, unless the diagnosis is certain. I am inclined to think it is this feeling that influences those authorities who recommend biopsy and sending the tissue to a number of pathologists for diagnosis. I have already suggested that it is wiser to send the roentgen films first.

A word more about toxin treatment and radiation. I find that roentgenologists in their treatment of the local bone lesion with radiation do not, with few exceptions, radiate the lungs. When metastasis is evident clinically and in the roentgenogram there is little time for radiation before death. There has been no systematic roentgen treatment of the lungs in a large series of bone sarcomas. In my small series all patients receiving the routine postoperative treatment of the lungs have ultimately died of metastasis.

As to the toxin treatment I have given it up, but I hope Dr. Coley and others will continue it. It is worth while finding out whether it really does increase the probability of a cure.

I must give Dr. Coley this further credit. The only case of sarcoma of bone which lived more than five years and then succumbed to metastasis to the lungs, had received the toxins before and after amputation for sarcoma of the humerus.

THE AMERICAN JOURNAL OF ROENTGENOLOGY AND RADIUM THERAPY

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Information of interest to all readers will be found on page iii. Lists of officers of The American Roentgen Ray Society and The American Radium Society will be found below.

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EDITORIALS

DEVELOPMENTAL ANOMALIES OF THE COLON—THEIR RELATION TO DISEASE

WITHIN the last few years more and more attention is being paid by thoughtful physicians the world over to the rôle played by the human constitution in the predisposition to disease. To be sure this concept is hardly a new one in medicine. Even the older masters were wont to classify their patients according to their general appearance, and it is in this way that we have derived the terms "apoplectic habitus," "phthisical habitus," "asthenic habitus," and so on. With the introduction of the roentgen method of visualizing the great body viscera, a new and powerful impetus has been given to such lines of thinking. We have come to formulate a sort of general hypothesis, if not an actual law, that external body configuration determines visceral shape and position, and that this in turn determines visceral function. Since it is but a step from visceral function to visceral malfunction, which is disease, we are now able, in certain cases, to predict from a consideration of the body habitus of a subject what disease he is most likely to have (should disease already exist), or what he is most likely to develop in the future.

This work on body habitus is today well established and well-nigh universally accepted, thanks largely to such brilliant and painstaking researches as those of the late R. Walter Mills, many of whose contributions were published in this Journal.

We are now in a position, however, to go a step further. If certain types of body habitus, as a whole, predispose to certain diseases, may not congenital *anomalies of individual organs* similarly predispose to specific *organic malfunctions?* To be sure, we have long been familiar with the fact that such anomalies exist. Anatomists and pathologists have for generations been demonstrating such specimens on the post-mortem table. However, these demonstrations have interested chiefly laboratorians, and the specimens themselves have been consigned to anatomical museums, which practitioners seldom if ever visit. The reason for this is not that these things lacked practical meaning for all of us, but that those who found them had no way of linking their post-mortem discoveries with the clinical picture during the life-time of the patient. In other words, they had no means of vitalizing this knowledge.

Once more it is the roentgen ray that has changed all this. By correlating the symptoms in large groups of living subjects with the roentgen findings in the same individuals, it is a simple matter to bring out significant clinical relationships, should such be present.

A convenient illustration of the working-out of the above views is furnished by some recent studies on the colon. This organ, owing to its long and variegated embryological development, is more prone than any other part of the alimentary canal to be the seat of congenital anomalies. It has been estimated that perhaps one-sixth of all subjects presenting digestive symptoms have colonic anomalies of one sort or another. If this is true, it becomes at once evident that we may obtain many valuable leads in the diagnosis and treatment of gastro-intestinal conditions by a much closer study of this organ than we have heretofore been accustomed to make. It is indeed possible that our attention is still too strongly focused on the uppermost part of the alimentary canal. This in fact is likely to continue to be the case until we fully realize and actually learn to believe that many symptoms attributed to the upper digestive tract are in reality due to conditions in the lower. Thus epigastric distress and belching may arise from distention or spasm of a loop of congenitally redundant colon; abdom-

inal colic no matter where situated may likewise be due to the same cause. Similarly, vomiting, regurgitation and nausea, as well as severe headaches, are very frequent accompaniments of another congenital colonic anomaly—namely the low cecum.

A very fascinating study indeed is opened up by these two common anomalies of the large intestine. Considered together they furnish many points of striking contrast. The redundant colon has to do primarily with the distal or evacuating portion of the large intestine. It is therefore most intimately associated with constipation. In fact persons afflicted with this condition are the most constipated of all patients, a week not infrequently elapsing between bowel movements. On the other hand, such subjects are often strikingly free from the so-called toxic or reflex symptoms of fecal stasis. Redundant colon is most common in men, and in persons of sthenic habitus.

As regards the low cecum, a condition involving the right or absorptive part of the colon, we find that it is far more common in women and in asthenics. These subjects furthermore are very decidedly afflicted with the so-called toxic or reflex symptoms of colon stasis. More than half of them vomit and many are subject to headaches. They constitute the "easy vomiters" or "neurotic vomiters" of everyday life.

Should the above findings be confirmed by further studies along these lines, it is important that they become widely known. Not only does understanding lead to effective therapy, but what is equally true, it puts an immediate stop to treatment that may cause possible lasting damage to the patient. Who can tell how often in the past we have treated upper abdominal colics due to redundant colon by cholecystectomy or by gastroenterostomy? Who can count the number of appendices that have been removed because of an overloaded low cecum?

One very important, if not an entirely novel lesson that we must learn from all this, is that the treatment of most colon anomalies is essentially a conservative, a protective therapy. When an anomaly is encountered, it is quite natural, at first blush, to try to do away with it entirely. Yet this is far more safely said than accomplished. The saying: "Remota causa, tollitur effectus" is not to be taken too literally in all cases. Besides it is not necessary to adopt radical measures. We are too prone to think in terms of classical acquired disease concepts, the symptomatology of which is constant and progressive, and generally cries for active intervention. The symptomatology of congenital anomalies on the other hand, is not fixed or constant, but varies greatly and disappears at times entirely, depending upon the whole compensating mechanism of the rest of the body. We are not dealing so much with ever-present acute symptoms, as with a *predisposition* to the development of malfunction at a point of least resistance—a predisposition that is increased by general systemic factors such as strains, fatigues, traumas, emotions and toxins.

In short, our one therapeutic ambition should be to restore colon function. Though its compensation is often broken by vicious habits and by irritating cathartics and irrigations, the large bowel has truly wonderul powers of recuperation. No matter how kinked or twisted, no matter how ptosed, bound down or rotated, many an anomalous colon can, with care and understanding and patience, be brought to a state of satisfactory function—for colonic malformations fortunately belong to that large group of congenital anomalies "which are compatible with life and with health under reasonably favorable circumstances."

JOHN L. KANTOR.

Subscribers to THE AMERICAN JOURNAL OF ROENTGENOLOGY AND RADIUM THERAPY *visiting New York City, are invited to make the office of* THE JOURNAL *(69 East 59th Street, New York) their headquarters. Mail, packages or bundles may be addressed in our care. Hotel reservations will gladly be made for those advising us in advance; kindly notify us in detail as to requirements and prices. List of operations in New York hospitals on file in our office daily.*

SOCIETY PROCEEDINGS, CORRESPONDENCE AND NEWS ITEMS

Items for this column solicited promptly after the events to which they refer.

CANCER OF THE LIP

LOCAL EXCISION VS. ROENTGEN AND RADIUM TREATMENT

To the Editor:

I wish to make my retort courteous to my friend and colleague, Dr. George W. Grier of Pittsburg, in reply to his letter published in your Journal for June, 1925, p. 582.

Dr. Grier does not agree with the evidence or the conclusions recorded in my letter published in your Journal of January, 1925. I have only one way of answering Dr. Grier—to repeat the statements made in that letter, and the readers must use their own judgment. In the Johns Hopkins Clinic it has been the rule of Dr. Halsted, his colleagues and assistants to make a local excision for lesions of the lower lip with the knife and to completely remove the glands of the neck, if the local lesion was considered malignant.

The records of all of these cases and, in addition, of all of my cases in the surgical clinic at St. Agnes Hospital, are still accessible in the surgical pathological laboratory of the Johns Hopkins Hospital, and, with few exceptions, sections of the original lesion on the lip and of the glands of the neck are there for restudy. These patients have been written to almost yearly for a period of thirty years. During this time many specimens from lip or glands have been received in the laboratory from outside surgeons, and with these cases we adopted the same follow-up system. From the beginning of roentgen-ray, and, later, radium treatment, we have numerous records of patients whom we had seen first, and advised operation and who, for one reason or another, decided to take roentgen or radium treatment. There is a a large number of records of patients who have come under observation after they had received roentgen and radium treatment.

Dr. Grier writes: "The fallacy underlying Dr. Bloodgood's criticism is that he is comparing good surgery with poor or ill-advised radiotherapy." In the majority of instances these patients received their roentgen or radium treatment by colleagues of Dr. Grier—the best trained technicians in this country. If Dr. Grier will come to my laboratory and read my index cards he will be compelled to withdraw the above statement. If any of his patients are there, he will find his name among the most distinguished roentgenologists and radio-therapeutists in this country and abroad.

My evidence shows that both radium and roentgen rays, have accomplished cures in the local growth of cancer of the lip. That is, patients who had a distinct local growth on the lip and who have received radiation have come under observation with involved glands of the neck which had also received similar extensive treatment. In a certain number of these cases, if the local condition justified any hope, we have removed not only the local lesion of the lip, but also the glands of the neck. The glands have shown cancer in all cases. In about one-half of the cases there was no evidence of cancer cells in the lip scar. In the remaining cases there were without doubt actively growing cancer cells. In the latter group the lip lesion as a rule was still ulcerating. This evidence seems to indicate that radium and roentgen rays in the hands of the most experienced technicians have failed to accomplish a cure in all cases. Let us compare this with the evidence of the complete local excision by Halsted and his school of surgery. There has not been a single local recurrence in a cancer lesion of the lip small enough to excise in the shape of a "V" and close without a plastic operation. My evidence therefore shows that surgery offers 100 per cent in cancer of the lip, and roentgen rays and radium do not.

As to Diagnosis in the Early Stage of Lesions of the Lip. Dr. Grier writes:

"If these cases are to be treated at all without radical operation, one must accept a clinical diagnosis, or challenge the honesty of the radiologist". . ."To remove a section from a cancerous lesion of the lip for study is unwise and dangerous as it greatly increases the chances of metastasis."

In regard to the latter quotation from Dr. Grier, he does not distinctly write that I advocate the removal of a piece for diagnosis, but it leaves that impression. I have never removed a piece for diagnosis in an operable lesion of the lower lip. Secondly, in regard to his first quotation, it is not a question of the honesty of the radiologist. It is simply a question of fact, as to the fallacy of clinical diagnosis. In the early stages of lesions of the lower lip it is impossible to make a correct clinical diagnosis. It is always a guess.

Let me picture the excision of a "V"-shaped piece from the lower lip for an early lesion involving the mucocutaneous border. The patient goes to the hospital the morning of operation. He may have his usual breakfast. The skin is cleaned with ether and alcohol. Procain is injected. The lesion is removed with a good margin of skin and mucous membrane, full thickness of the lip, and the piece removed is the shape of the letter V. The lesion at the muco-cutaneous border is in the center of the base of the V. The wound is closed with interrupted fine black silk. Rarely does a vessel require ligature. The wound is dressed with silver foil and collodion, fixed with gauze-collodion and adhesive straps. The patient goes about his business. The wound is redressed in twenty-four hours. The stitches are removed from the fourth to the sixth day. A collodion fixation dressing is worn for perhaps ten days. The piece removed is studied microscopically, and if there is definite evidence of a fully developed carcinoma of the spinal-cell type, the glands are removed.

You will observe the economy of time and material. There is no more discomfort and perhaps less than in the filling of a tooth cavity. If it is cancer, it offers 100 per cent chances of a cure, as far as the lip is concerned. When the glands are removed and are negative for cancer, it is still 100 per cent. If they are positive the chances of a cure are 50 per cent.

We have no evidence that roentgen rays or radium alone have ever accomplished a cure when the glands are involved.

What explains the attitude of Dr. Grier, Dr. Pfahler, Dr. Ewing and the majority of the experienced men who rather favor roentgen rays and radium in cancer of the lip? In the first place I feel that the majority of their cases are late cancers of the lip, where local operation would mean a plastic one with mutilation, and where the glands are so extensively involved that complete removal is out of the question. Our entire past experience has shown that incomplete operation with the knife never accomplishes a cure, there is rapid recurrence rendering the patient more uncomfortable than before operation. In these cases radium and roentgen rays with electric coagulation or without it, or with or without some other form of cauterization, prolong the patient's life and add to his comfort. In these late stages of cancer of the lip, because of the extensive local growth, or in cases of extensive glandular involvement roentgen rays and radium have their distinct place among the therapeutic agents of palliation.

Since the writing of the letter which Dr. Grier takes exception to, the evidence in favor of my positon has increased, but I do not expect to convince my colleagues among the radiologists until they themselves have an opportunity to observe the earlier stages of cancer and lesions that are not cancer, in the lower lip; until they are convinced that the microscope is the final judge of the diagnosis.

Perhaps the American Roentgen Ray Society and the American Radium Society will follow the example of the College of Surgeons and appoint a committee to investigate the results, similar to the labors of Greenough's Committee in regard to cancer of the uterus, or to follow the more laborious and difficult plan of Codman and request members of the medical profession to register their five-year cures with their evidence.

JOSEPH C. BLOODGOOD.

SIXTH ITALIAN CONGRESS OF RADIOLOGY

TRIESTE, MAY 7, 8, 9 and 10, 1925

The 6th Congress of Radiology was held at the Ospedale Civile Regina Elena di Trieste under the presidency of Prof. Massimiliano Gortan and was participated in by many physicians and technicians. More than 170 papers were presented. the subjects treated at the various sessions were as follows.

1. Radiology of the biliary tract (Prof. Tandoia, Naples).

2. Radiology of affections of the pleura (Prof. Pesci, Genoa).

3. Radiotherapy of the endocrine glands (Prof. Milani, Rome).

Prof. Donati (Padova) in a lecture explained his radio-surgical studies of the pathology of the duodenum and Prof. Holzknecht (Vienna) discussed present points of view in the therapy of tumors.

The individual papers were fully discussed and commented on and supplemented by communications touching upon the subjects treated. Special interest was awakened by the observations of Drs. Rossi, Perussia, Vespignani, Alberti, Palmieri and Ponzio, and their diagnostic and therapeutic arguments.

Other important communications were those of Bertolotti (Turin) on intracranial lesions, of Sluys (Brussels) on radium therapy of malignant tumors, and of Bassi and Pugno-Vanoni on present tendencies in the technique of electrotherapeutics.

Of great interest also were the communications of Prof. Gortan (Trieste), Piccinino (Naples), etc., in relation to the diagnosis of intraspinal lesions by means of injections of lipiodol.

A great display of roentgenographic diapositives was given at the 6th Italian Congress illustrating cases which were complicated in diagnosis and of special clinical value.

As usual there was also an exhibit at the Congress of roentgenological apparatus. Many firms exhibited; among them the Italian firms of Balzarini, Gola, Cardolle and Meschia fully demonstrated that the Italian industry is thoroughly able to compete with the best foreign houses.

The general assembly of the members called in connection with the congress elected as honorary members of the S.I.R.M. Senator Prof. Edoardo Maragliano (Genova) and Prof. Guido Holzknecht (Vienna), and chose for the years 1925–1926 as President Prof. Tandoia (Naples), Vice President Prof. Pesci (Genoa) and re-elected as Secretary-Treasurer Prof. Ponzio (Turin) and chief editor of the journal Prof. Perussia (Milan).

Naples was selected as the seat of the 7th Congress under the presidency of Prof. Sgobbo.

M. PONZIO.

MEETINGS OF ROENTGEN SOCIETIES

We contemplate the publication of a list of roentgen society meetings such as that below, in each issue of the Journal, gradually adding other home and foreign societies as the information reaches us. Secretaries of societies not here listed are requested to send the necessary information to the editor.

NEW YORK ROENTGEN SOCIETY
Secretary, Dr. Eugene V. Powell, 217 East 42d St.
Meets monthly on second Monday, New York Academy of Medicine.

THE CANADIAN RADIOLOGICAL SOCIETY
Secretary, Dr. E. C. Brooks, Montreal.
Meets annually.

ROENTGEN RAY SOCIETY OF CENTRAL PENNSYLVANIA
Secretary, Dr. W. E. Reiley, Clearfield, Penna.
Two meetings a year, April and October.

THE NEW ENGLAND ROENTGEN RAY SOCIETY
Secretary, Dr. Frank E. Wheatley, 520 Beacon St., Boston, Mass.
Meets monthly on third Friday, Boston Medical Library.

PHILADELPHIA ROENTGEN RAY SOCIETY
Secretary, Dr. Eugene Pendergrass, University of Pennsylvania, Philadelphia.
Meets monthly on first Thursday evening, Pennsylvania Hospital.

CHICAGO ROENTGEN SOCIETY
Secretary, Dr. Edward S. Blaine, 2005 S. Wabash Ave.
Meets monthly on second Friday from October to May (except during month of December) at Virginia Hotel. Dinner at 6 P.M., scientific session at 8 P.M.

PACIFIC COAST ROENTGEN RAY SOCIETY
Secretary, Dr. Harold B. Thompson, Seattle, Wash.
Two meetings a year.

CLEVELAND RADIOLOGICAL SOCIETY
Secretary, Dr. E. P. McNamee.
Meetings are held at 6 o'clock at the University Club, on the fourth Monday evening of each month from September to April, inclusive.

CENTRAL ILLINOIS RADIOLOGICAL SOCIETY
Secretary, Dr. C. J. McCullough, Decatur, Illinois.
Regular meetings held quarterly.

SOCIETA ITALIANA RADIOLOGIA MEDICA
Secretary, Professor M. Ponzio, University of Torino, Torino.

THE BRITISH RÖNTGEN SOCIETY
Meets on the first Tuesday of each month from November to June inclusive, at 8.15 P.M., at the British Institute of Radiology, 32 Welbeck St., London, W. 1.

ELECTRO-THERAPEUTIC SECTION OF THE ROYAL SOCIETY OF MEDICINE (CONFINED TO MEDICAL MEMBERS)
Meets on the third Friday of each month during the winter at 8.30 P.M. at the Royal Society of Medcine, 1 Wimpole St., London, W. 1.

BRITISH INSTITUTE OF RADIOLOGY
Secretary, Dr. John Muir, 32 Welbeck St., London, W. 1.
Meets at 32 Welbeck St., but regular dates and times of meeting have not yet been arranged.

SCANDINAVIAN ROENTGEN SOCIETIES
The Scandinavian roentgen societies have formed a joint association called the Northern Association for Medical Radiology, meeting every second year in the different countries belonging to the Association. Each of the following societies meets every second month except in the summertime:

SOCIETY OF MEDICAL RADIOLOGY OF SWEDEN
Meets in Stockholm.

SOCIETY OF MEDICAL RADIOLOGY IN NORWAY
Meets in Oslo.

SOCIETY OF MEDICAL RADIOLOGY IN DENMARK
Meets in Copenhagen.

SOCIETY OF MEDICAL RADIOLOGY IN FINLAND
Meets in Helsingfors.

DUTCH SOCIETY OF ELECTROLOGY AND ROENTGENOLOGY
Meets in Amsterdam every second month except in the summertime.

ASSOCIATION OF GERMAN ROENTGENOLOGISTS AND RADIOLOGISTS IN CZECHO-SLOVAKIA
Secretary, Dr. Walter Altschul, German University, Prag, II/52.
Annual Meeting in Prag the last week of October.

BOOK REVIEWS

Books Received Are Acknowledged under Heading: Books Received. This must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

TEETH AND JAWS ROENTGENOLOGICALLY CONSIDERED. By Herman A. Osgood, M.D. Cloth. Price, $10.00. Pp. 99, with 407 illustrations. New York: Paul B. Hoeber, Inc., 1925.

This book is Volume v of the Annals of Roentgenology, a series of monographic atlases edited by James T. Case. The author's purpose, as he states in the preface, has been to establish a guide for differential diagnosis of lesions about the teeth and jaws. The book contains three hundred and fifty-three roentgen-ray studies on seventy-two full page plates. From the dentist's standpoint, more might have been said of the value of the clinical examination, including the electric test, as an aid in arriving at a correct diagnosis of pathologic conditions about the teeth. Exception also might be taken to the diagnosis of fracture of the alveolus, based on the break of the normal occlusal plane, in Figure 344. The condition might very well be due to the absence of opposing teeth in the upper jaw.

The subject matter, however, is logically presented, the plates are excellent, and the book is well worth the careful study of everyone doing dental roentgenography.

L. M. CHRISTIE.

HANDBUCH DER RÖENTGENTHERAPIE. III. Band des Handbuches der gesamten medizinischen Anwendungen der Elektrizität einschliesslich der Röntgenlehre, 2 Teil, Lieferung 8: Die Röntgentherapie bei chirurgischen Erkrankungen. 1. Allgemeiner Teil. By Dr. med. Hans Holfelder, Universitätsklinik, Frankfurt a. M. Paper. Price 9.6 marks. Pp. 190, with 63 illustrations and 3 tables. Leipzig: Werner Klinkhardt, 1925.

Appearing at a time when there is considerable controversy on the question of whether roentgen dosage should be delivered all at once or in small frequent doses, this book comes out uncompromisingly for a carefully calculated dose delivered preferably at two sittings on consecutive days. With apparatus calibrated accurately by ionization measurements as directed, Holfelder holds that this procedure is perfectly safe, and he presents considerable biologic evidence against broken doses. He insists on waiting for a repetition of the dose until the effect has passed off, and emphasizes that the ultra-hard rays now used produce a very slow reaction, so that the dose must not be repeated within two months. He recommends modern apparatus which is capable of delivering the full dose within a few minutes, and points out that a hospital which goes to the expense of replacing obsolete low power therapy apparatus by the modern ultra-powerful will more than make up for the expense by the economy of treating carcinoma as an out-patient condition, which cannot be done when low-power apparatus requires long and exhausting sessions. In addition to proper protection of the patient, he insists on protection of the operator not merely by a lead panel, because it is now definitely known that the ultra-hard rays set up a secondary radiation all over the room; and not by a small coop of a lead booth, cramped for room and lacking in light and air. He demands a whole ray-proof attendance room, preferably between two radiation rooms, and having its own outside windows.

Two other controversial matters in which Holfelder takes a definite stand are: the stimulating effect of insufficient dosage, and the humoral concept of tumor-immunity, to both of which he subscribes. The latter consideration has a practical bearing on the roentgen prophylaxis of recurrence of surgically removed cancer: he prefers to irradiate the lesion before it is removed, that the humoral processes of immunity may be stimulated by the action of the rays on the carcinoma cells—a condition the lack of which he blames for the disappointing results of post-operative prophylactic radiation. As for the question of when to irradiate and when to operate, Holfelder comes out clearly for the earliest possible operation on cases that are really operable; but he charges surgeons with indifference to the potency of radiation as a means of therapy when the case is beyond surgical cure. He warns against expecting roentgen rays to do the impossible; in many cases the object must be merely the prolongation of life with the alleviation of suffering not hoping for a permanent cure. The volume includes no statistics.

It is not possible to do justice in a review to the thoroughness with which Holfelder sets forth the principles of the homogeneous deep dose which he regards as a *sine qua non*, or the minute directions he gives for producing it by the use of his field selector, by which he

limits the radiation as completely as possible to the lesions. He regards keeping the volume of heavily radiated tissue to a minimum as the greatest single factor in preventing roentgen sickness. It is pleasant to note the credit given to American workers, early and contemporary. Thus, "the first electroscope for the ionization measurement of roentgen rays was constructed in 1905 by the American, Franklin." The work of Murphy and of Wood and Prime comes in for commendation.

The bibliography includes approximately 600 titles. Due to delay in preparation of the second or special section of the book, the special section will appear later.

RAMSAY SPILLMAN.

INTERNATIONAL ABSTRACTS OF ROENTGEN AND RADIUM LITERATURE

ROENGTEN DIAGNOSIS

BECCHINI, GASTONE. Gastric and pyloric spasms. *Radiol. med.*, July, 1924, xi, 422–448.

Three cases of spasm are reported which presented some rather unusual features in regard to commencement, duration and site of the spasm. The first case was in a patient with Malta fever who came for an examination of the digestive tract because he had had hematemesis some months before and suffered from time to time with slight epigastric pain. When given a barium suspension followed by an ordinary meal a quarter of an hour later there was stagnation of the barium in the stomach for a period of more than twenty-four hours. When given a barium suspension not followed by food the evacuation time was normal, so that the spasm was evidently due to food. It was not organic as the pylorus was permeable.

The second case was one of pyloric spasm in a young woman who for three years had suffered from periodic pain in the stomach. Roentgen examination showed intermittent spasm near the site of the ulcer which evidently produced the spasm. This is contrary to the usual observation that intermittent spasm is produced at a distance from the lesion which provokes it while spasm near the lesion is generally continuous.

In the third case the patient for four years had slight late epigastric pain and pyrosis. He proved to have a combination of organic lesion and spasm in which however the latter predominated. There was a callous hypertrophy of the pylorus which however only partly closed it. After a barium meal there was stagnation for a period of four days. Unusual phenomena in the motility of the stomach may be explained by the varying tonicity of the vagus and sympathetic systems and their action on the stomach.

BORGHERINI-SCARABELLIN, ALESSANDRO. Swallow's nest hydropneumothorax. *Radiol. med.*, September, 1924, xi, 558–562.

Frequently an inflammatory process of the pleura develops in the course of a pneumothorax. If thoracentesis is performed for the purpose of emptying the fluid it is sometimes found that adhesions have formed between the parietal and visceral pleura which may divide the pleural cavity into several chambers so that it is necessary to puncture at several different levels to remove all the fluid. This form of affection has been named swallow's nest hydropneumothorax. Roentgenoscopic examination shows these accumulations of fluid at different levels; generally the amount in each cavity is small but it may be as much as a liter or more.

The treatment is to break up the adhesions. In some cases, as for example in one described, they may be ruptured by applying a pneumothorax under very high pressure but in other cases they have to be resected by operation or with the galvanic cautery if the type of adhesion is suitable.

BRUNETTI, L., and FILIPPINI, G. The use of opaque salts in the roentgenological demonstration of the antrum of Highmore and cysts of the superior maxilla. *Radiol. med.*, August, 1924, xi, 469–506.

There are numerous anatomical variations such as asymmetry of the sinuses, varying thickness of the walls, varying size of the cavity and the possible existence of septums or accessory cavities which may be more or less pneumatized, which sometimes make differential diagnosis difficult or impossible with the usual methods of roentgen examination, especially when it is a question of operation, and in fact roentgen examination may give rise to absolutely wrong conclusions.

The authors have taken up an idea already suggested by others, namely, the use in diagnostic roentgenology of opaque substances, but this idea, although it has been proposed before has not been sufficiently worked out as to technique. They have made a series of preliminary studies and worked out a technique which they have tested on several patients with better diagnostic results than by any previous method.

For a study of the maxillary sinus, if the sinus communicated with the outside only by the natural orifices they use an injection of a sterile 15 per cent solution of potassium iodid by the method of exploratory puncture of the sinus. The possible use of a gummy suspension of barium sulphate in certain classes of these sinuses is being studied. If the sinus communicates with the outside air by larger or smaller openings of a pathological nature they use a gummy suspension of barium sulphate injected through the pathological opening.

For the examination of large cysts of the superior maxilla they use a gummy suspension of barium sulphate if the cyst communicates

freely with the exterior, as irrigation of the cyst is possible in these cases, and they make use of the same opening for the introduction of the opaque suspension. In closed cysts they use 15 per cent potassium iodid taking care to substitute the potassium iodid gradually for the cystic fluid by means of two needles running in opposite directions, only one of which is mounted on a syringe, and in later irrigations using the same technique to replace the potassium iodid with sterile water to eliminate as soon as possible the endosmotic action of the hypertonic solution.

Filippini adds a special part with numerous case histories and roentgenograms in which he describes the rhinological applications of the method, citing many examples in diagnosis and pathology in which its usefulness has been demonstrated. Brunetti discusses the value of this new method of roentgenological technique in stomatology, reporting several clinical cases.

CALOT. Congenital subluxation of the thigh is ten times more frequent than luxation and their rôle is greatly disregarded. *Bull. Acad. de méd., Par.*, 1925, 3. s., xciii, 77–79.

Congenital subluxations are almost always disregarded, especjally in the thigh. They are recognized best by a combination of clinical examination, antecedents and by the roentgenogram. The rôle of such a condition is more important than ordinarily considered, and it is suggested that more care be given to diagnosis. The roentgenogram is an important factor in such diagnosis.

CASOLO, GIOVANNI. Sacralization of the fifth lumbar vertebra. *Radiol. med.*, June, 1924, xi, 357–378.

Sacralization of the fifth lumbar vertebra has long been known to anatomists but it has not been considered of any clinical importance until within the last decade. Since then there has been rather too much of a tendency to ascribe any lumbar or sciatic syndrome to it. The author has found it in 2.5 per cent of the roentgenograms that he has taken of the lumbosacral spinal column. There are some difficulties of an anatomical nature in taking reliable pictures of this part of the spinal column, notably the variable degree of inclination of the fifth lumbar segment to the sacrum. If the results are doubtful a picture of the whole spinal column should be taken. Seven degrees of the anomaly are described and illustrated with roentgenograms. Bertolotti's syndrome was found in 58 per cent of the cases in which there was a roentgen picture of sacralization. A painful syndrome should be attributed to sacralization only when (1) the pain is on the same side as the malformation; (2) the anomaly is very pronounced, and (3) all other causes of sacroiliac and lumbar pain can be excluded. The latter, of course, is difficult as there are many causes for such pain.

The degree of ossification found in infancy, though it may not be complete, represents the final form of the anomaly. Sacralization of the fifth lumbar vertebra is therefore congenital. The symmetrical form is much more frequent than the asymmetrical form, the proportion being 74 per cent to 26 per cent. The pathological syndrome may be defined as a disease of the new-formed accessory foramen which is caused, or at least increased by the anatomical conditions. Normally the nerve with its accompanying veins passes through the foramen without being compressed but in sacralization varying degrees of pressure are exercised on it which may cause severe pain. The disease may begin early in life, it may coincide with the time of complete ossification of the spinal anomaly or it may begin late—even after forty years of age. The causes which determine it are sometimes innate in the ossification of the anomaly but sometimes general pathogenic agents cause it, such as rheumatism, congestion, different diatheses, varices of the satellite veins of the fifth lumbar nerve at its origin; these act on the point of least resistance which in these individuals is the anomaly in the spinal column. The painful syndrome in the symmetrical forms is particularly apt to be lumbar; in the asymmetrical forms it may be lumbar or sciatic. Physical examination does not give reliable information and it must always be supplemented by roentgen examination. This examination generally shows that there is a neuralgia of the lumbar or sacral plexus, but there is a true neuritis only in the more severe and stubborn cases. The neuralgia is explained by the theory that the fifth lumbar nerve suffers compression or traction in the accessory foramen with secondary traction on the cauda equina. Signs of degeneration of the nerve do not develop until much later.

The prognosis is almost always good so far as length of life is concerned, though recurrence of the malady is very frequent. Electrotherapy and roentgen therapy may be used in treatment. In roentgen treatment the rays are converged in the lumber region on the point where the nerve trunks emerge. Hard rays are used filtered through 0.5 mm. zinc and 1 mm. aluminum with an intensity of 2 ma., focus skin distance 35 cm. The rays are applied for 20 minutes each on 3 consecutive days. After an interval of twenty-five days a second series is given and if necessary after twenty-five more

days, a third. Generally the patients are quickly relieved, sometimes after only 5 applications. Surgery should be used only as a last resort after other methods have failed. The object of operation is to enlarge the foramen and this is accomplished by resection of the sacralized transverse process.

DURANTE, LUIGI. Two cases of Osgood-Schlatter's disease and the value of roentgenologic examination. *Radiol. med.*, September, 1924, xi, 573.

The cause of Osgood-Schlatter's disease is quite generally thought to be a trauma acting secondarily on an inflammatory process or a disturbance of ossification. The author describes 2 cases in boys of fourteen and fifteen in which there was no history of trauma. There was a family history of tuberculosis in one case and the patient had a tracheo-bronchial adenopathy and signs of a healed tuberculosis of the right apex.

A critical examination of almost all the roentgenograms of Osgood's disease reported in the literature, as well as those in his own cases, shows that the fragments wholly or partially detached from the tuberosity which appear in all of them are due to an osteophytic process and that there is no demonstrable relation to trauma. An examination of roentgenograms of young individuals from ten to twenty years of age, made with the object of obtaining personal knowledge of the normal picture of the anterior tuberosity of the tibia in its different stages of development has shown that there are roentgenograms which present the bone lesions described as typical of Osgood's disease but the subjects have never had any of the clinical symptoms of the disease.

In order for this slight modification in the ossification of the tuberosity of the tibia to produce the clinical signs of Osgood's disease it is necessary for some cause of an inflammatory nature to act on the anatomical change due to the disturbance of ossification. This fact would explain the pain, turgor and redness of the tuberosity and the surrounding tissues. This second factor is necessary because the disturbance of osteogenesis of the tuberosity of the tibia in itself does not produce the clinical symptomatology of Osgood's disease in cases where the two factors are not present. The disturbance of ossification of the anterior tuberosity of the tibia is quite frequent in rather delicate young people. The nature of the inflammatory process which causes the actual disease is as yet unknown. It will require a study of material obtained on operation to clear up this last obscure point in regard to the etiology of Osgood's disease.

GIRAUD, PAUL, and SIMON, JEAN. The lipiodol roentgen diagnosis of broncho-pulmonary affections of infants. *Marseille méd.*, 1925, lxii, 434–438.

A review is given of the technique of injection of lipiodol for roentgenograms of the bronchioles and lungs of children. The subglottic method of injection is absolutely unfit for use in infants, for the lipiodol passes entirely into the intestines. The transglottic is the surer method and is used in most cases. Local anesthesia with novocaine is accomplished with the aid of a mirror and by means of a curved cannula. A few minutes later 10 c.c. of warm lipiodol is injected, the infant being held in an inclined position. Using an instrument specially devised by Rosenthal, the lipiodol may be injected intercrico-thyroidally with even better results. Roentgenograms are given to illustrate the clear results obtained by the latter method. The clearness with which the cavities of the lungs are brought out is emphasized, and 3 cases are mentioned in which this was of very great value in treatment instituted.

GUARINI, CARLO. Unusual case of calcified echinococcus cyst of the liver. *Radiol. med.*, August, 1924, xi, 511–513.

The patient had suffered for a long time from fever and intermittent icterus. She complained of attacks of colicky pain in the right upper quadrant of the abdomen which yielded to hot compresses and sedatives. She had been treated for kidney stone and was sent to Guarini with that diagnosis. She complained that she felt as if there was a stone in her abdomen and localized it by putting her hand over the liver region. A roentgenogram of the right kidney region showed an ovoid shadow extending from the tenth to the twelfth ribs with its longest axis extending from without inward and form above downward. It had a marbled appearance and its margin was clearly defined. A second roentgenogram was taken of the whole liver region and showed that the shadow lay within the liver. A diagnosis of calcified echinococcus cyst of the liver was made and confirmed by operation.

GUARINI, CARLO. Three cases of oxycephaly. *Radiol. med.* September, 1924, xi, 580–585.

Roentgenograms are presented of 3 cases of oxycephaly in boys fourteen, eight and three years of age. Various names are given to this condition, such as oxycephaly, acrocephaly and tower skull. It is characterized by a high vertex and reduced anteroposterior diameter of the cranium. There is premature synostosis of the sutures which, according to Virchow, is due to

inflammation of the meninges. According to Bertolotti the changes in the base of the cranium and those in the sella turcica and hypophysis are due to the synostosis of the vault. There is increased intracerebral pressure and as a result digital impressions on the skull. The facial bones, especially the superior and inferior maxillae, are small. All of the author's patients were born blind and all of them had hydrocephalus, but the hydrocephalic liquid and the pressure decreased with increasing age; it was greatest in the youngest and least in the oldest. The atrophy of the optic nerve is probably due to the increased intracranial pressure, though there are some authors who deny this. The majority of authors are agreed that oxycephaly is caused by hereditary syphilis.

GUISEZ, J. Some little recognized forms of diverticulum of the esophagus. *Bull. Acad. de méd.*, Par., 1925, 3. s., 378–381.

Certain forms of diverticulum of the esophagus are often very difficult to identify. In such cases the esophagoscope and the roentgenogram are essential for diagnosis. Three cases are reported, 2 of which were diagnosed by means of the esophagoscope and the other by the roentgenogram after bismuth meal. The position, size, etc. are plainly shown by the bismuth in the roentgenogram.

IMBERT, LEON. Note on bone grafts, *Bull. Acad. de méd., Par.*, 1925, 3. s., xciii, 204–214.

Roentgenograms are given to illustrate the progress of calcification in bone grafts, the position of the bones, processes of regeneration, etc. The roentgenogram is of great value in such cases for the condition of the graft can be watched throughout the healing process, and dead bone can be quickly determined. In the cases reported, the existence of dead bone in grafts is emphasized, decalcification is very clearly noted.

LA MENDOLA, SALVATORE. A case of achondroplasia. *Radiol. med.*, July, 1924, xi, 438–441.

Roentgen rays have contributed greatly to differentiating achondroplasia from other diseases of bone. The author describes a case in a child of fifteen who has not yet attained puberty, showing a lack of hypergenitalism associated with the achondroplasia. The patient presented the classical picture of achondroplasia, and roentgen examination confirmed the shortness and curvature of the long bones; they were denser than normal, some of them were surmounted with crests and the epiphyseal cartilages were transparent. The sella turcica was flattened vertically and was smaller than normal. The petrous bone presented a prominence which divided the base of the skull into two fossae. The sella turcica is generally flattened in the anteroposterior direction and the cavity dilated. Pharmacological tests of the glands of internal secretion did not show clearly any change of function of the hypophysis or thyroid, nor did they show a pronouncedly sympathico-tonic or vagotonic temperament except that perhaps a certain degree of vagohypotonia was indicated by the results of atropin injection. The small size of the sella turcica indicated defective development of the hypophysis but the persistence of the epiphyseal cartilages showed that its function was not entirely lacking.

He concludes that hypophyseal function influences the formation of the primary centers of ossification while that of the thyroid influences the growth of the skeleton and the activity of the epiphyseal cartilages. Achondroplasia is essentially a fetal disease; it affects the skeleton during the first few weeks of intrauterine life. Arrest of development of the epiphyseal cartilages is not essential to achondroplasia; it may be added to the picture and give it a more serious character, adding the feature of hypothyroidism to that of dwarfism. But in the majority of cases neither hypergenitalism nor hypothyroidism are essential to this disease which is really a fetal chondrodystrophia as defined by Kauffmann.

LAPLANE, LOUIS. The interpretation of the roentgenologic images in the subarachnoid lipiodol test. *Marseille méd.*, 1925, lxii, 297–314.

Experience of the author with lipiodol injected into the subarachnoid area shows that in many cases false images are noted due to temporary stagnation of the oil in segments of the spinal column. This is especially true if the patient is not standing erect when the oil is administered and when the roentgenogram is made. These images resemble bubbles of air and are easily dispersed when the patient is placed in a vertical position. Very often the oil may adhere to the wall of the meninges and cause a "physiologic arrest," and a certain amount of stoppage results. This, however, is usually only partial and transitory. Arrest of the oil in pathologic conditions is quite clear in that the image is solid and remains regardless of the position of the patient. True arrest of the oil is unmistakable, but "false arrest" and "physiologic arrest" may cause some confusion. Many drawings are given to illustrate various conditions in which this is shown, as well as some showing true arrest in pathologic conditions.

LEGUEU. The cysto-roentgenogram *Progrès méd.*, 1924, No. 15, 234–236.

This is a discussion, and more or less of a review, of the advantages of the roentgenogram in the study of internal organs by means of bismuth carbonate, with special reference to the bladder and the urinary tract. By means of the cysto-roentgenogram the exact form, position, etc., of the urinary tract can be determined. Various pathological conditions can be more readily studied in this way. The form of the uterus, whether regular or irregular flexuous, etc.; whether the renal cavity is distended or not; determining the causes of renal insufficiency; form of the bladder, etc. Operative procedures can the more easily be determined. The method is of much importance in urology.

MAINOLDI, PIETRO. Jackson's pericolic membrane. *Radiol. med.*, June, 1924, xi, 382–387.

In 1922–23 fifteen cases of Jackson's membrane were found on operation in the surgical clinic of the University of Bologna. Radiological examinations were made of 6 of these and details of the case histories are given together with 4 roentgenograms. Another case operated upon elsewhere is also reported. The author concludes from an examination of these cases, all of which were ones of true pericolic membrane, that there is no roentgenologic picture typical of Jackson's membrane. Some cases of Jackson's membrane, verified on operation, did not show a roentgen picture and the majority of the abnormal features which have been described by other authors as being present in the picture of the right colon in certain cases of Jackson's membrane cannot be regarded as pathognomonic.

PIERGROSSI, LAMBERTO. Pulmonary and pleural sarcomatosis. Active and clinically healed pulmonary tuberculosis. *Radiol. med.*, July, 1924, xi, 430–437.

A case of sarcoma of the lung in a man of thirty-one is described. He was operated upon for a tumor in the left kidney region which was found to be inoperable and was treated with roentgen rays. In the course of an examination of the digestive tract numerous round opaque spots were seen in the lungs; they were well defined, scattered throughout the lung fields and about the size of hazel-nuts. Clinical examination of the thorax was negative in this and also in the following case. Two weeks later he had an acute attack of bronchopneumonia of which he died. This attack was undoubtedly due to the metastatic sarcoma which would not have been suspected if it had not been for the roentgen examination.

The second case was in a man of fifty-five who had attacks of asthma and retrosternal pain. A diagnosis of aneurysm or dilatation of the aorta had been made. Roentgen examination showed the lungs strewn with a multitude of round, well-defined spots the size of a lentil. There was a dark mass in an oblique position in the posterior mediastinum where the tumor probably originated. The outcome of this case is as yet unknown.

A third case of sarcoma of the pleura presented the picture of exudative pleurisy. Many exploratory punctures were made, all of which were entirely negative. From the picture alone a differential diagnosis from an ordinary pleurisy could not have been made, but the diagnosis of sarcomatosis was made from the fact that another picture showed subclavicular and axillary glands, and that there was no fever. The patient died five or six months after the commencement of the disease.

A case of echinococcus cyst of the lung in a woman of forty is also presented. It had ruptured into a bronchus and gave rise to frequent attacks of hemoptysis followed by the expulsion of membranes. Finally the patient had an unusually severe attack during which the whole contents of the cyst was discharged, after which she recovered. The interesting point in this case was that a roentgenogram taken five months later showed a very extensive calcification of the bronchial tree on both sides which had not been present in the former picture. This suggested to the author that this calcification was related to the process of healing, and he studied the question in cases of tuberculosis to see whether data could not be obtained for making a differential diagnosis between cases which were active, ones clinically healed and ones amenable to cure. His theory is that an overproduction of calcium and a deposition of it at a distance from the pathological focus indicates a tendency to healing of the process. In confirmation of this theory he presents cases of tuberculosis clinically healed, with extensive deposits of calcium, and cases of active tuberculosis in which there is a deposit of calcium only at the site of the lesion.

A plate showing 9 roentgenograms illustrates these cases.

SESSA, PIERO. Cases of biliary calculosis with unusual radiological findings. *Radiol. med.*, August, 1924, xi, 507–511.

A woman of fifty-three had had indefinite pain in the region of the right kidney for two years without any urinary symptoms. A floating kidney was found on the right, for which operation was advised but the patient refused. The attacks of pain became more frequent

and severe and she was obliged to return to the hospital. No digestive nor urinary symptoms, no fever, hematuria, nor icterus. A tumor of the right lower quadrant of the abdomen had developed in the meantime. Roentgen examination showed the right kidney apparently normal in size and beside it in the lumbar region outside the urinary tract there was a shadow the form and size of a lemon. It was placed vertically with a slight obliquity which was variable. It was evident that the mass was not attached to the urinary tract and roentgen examination seemed to show that it was independent of the digestive tract also, though a definite differential diagnosis from some form of calcified cyst of the mesentery could not be made. A diagnosis of calculous cholecystitis was made in spite of the absence of clinical symptoms and was confirmed by operation.

The frequent coincidence of biliary calculi and neoplasm of the liver is discussed. Some authors think this is mere chance and do not believe that the inflammatory process in lithiasis can create a predisposition to new growths. But they do admit that the interference with the flow of bile caused by a tumor may favor the development of stones. But Berthold gives statistics which show a much higher coincidence of stones in primary than in secondary new growths, which would not be the case if the calculi were secondary to the neoplasm.

Four roentgenograms of the above described case are given and a fifth one of a second case which is only briefly mentioned as having presented the typical clinical picture of cholelithiasis.

ZORZI, PIETRO. Radiological observations on dolichosigmoid. *Radiol. med.*, June, 1924, xi, 388–402.

The term dolichosigmoid was first introduced by Lardennois and Aubourg to indicate an abnormally long sigmoid. It cannot always be distinguished from megasigmoid as elongation and dilatation often coexist. Zorzi discusses 12 cases, especially from the roentgenologic point of view, giving 6 roentgenograms. He discusses the question of their etiology and their pathological significance. He makes a distinction between a left and a right dolichosigmoid, depending on whether the long sigmoid loop lies to the right or left of the spinal column. In the former type of case there is more apt to be colic and pericolic inflammation. The degree of elongation is not proportionate to the intensity of the symptoms produced. The symptoms in the cases described were functional symptoms of the digestive tract, constipation or constipation alternating with diarrhea, feeling of heaviness, distention, etc. Palpation was always negative and there was no irregularity of the abdominal wall to indicate the abnormal development of the intestine. This seems to be due to the fact that the flexure is higher up in the first type than in the second.

With regard to etiology the author does not believe that dolichosigmoid results from accumulation of feces in the sigmoid loop. In the cases which he has observed roentgenologically he has never observed such an accumulation of feces in the sigmoid nor has he seen any important change in the manner in which the feces passed through the sigmoid. But he has often noticed a great retardation, almost inertia, in the process of evacuation.

The cases observed were seen in patients with all kinds of constitution, which is not in harmony with the hypothesis that these elongations are constitutional in origin. Perhaps the cause lies in a functional disturbance of the neuromuscular complexes which regulate the motility of the large intestine.

ROGER, H. Secondary cancer of the spinal column. *Marseilles méd.*, 1925, lxii, 238–272.

The use of the roentgenogram with the aid of lipiodol, and subsequent roentgen treatment of cancer of the spinal column are described. The lipiodol is injected in the subarachnoid area; as it descends, any body which stops its progress is plainly distinguished. Cancers in the vertebrae cause the oil to be interrupted in its course downward and the subsequent roentgenograms outline the position, size, etc., very clearly. Illustrations of cases are given. Treatment with deep roentgenotherapy is largely preventive, in that it retards metastasis and reduces, temporarily at least, the size and congestion of the cancerous area. A combination of roentgenotherapy and surgical interference is the only recourse.

ARMANI, LODOVICO. Roentgenological study of subacute and chronic intestinal invagination. *Radiol. med.*, February, 1925, xii, 53–63.

Very few cases of intestinal invagination are described in the treatises on roentgenology and therefore the author thinks it worth while to describe the 6 cases which he has examined roentgenologically and verified at operation. He adopts the classification of Rafinesque and Nothnagel into very acute cases, lasting twenty-four hours, acute ones lasting two to seven days and subacute or chronic lasting for from two weeks to many months. Statistics are presented showing that the acute form is the one most frequently encountered, that it is localized

in the majority of cases in the ileocecal region and affects the male more frequently than the female. He reviews the predisposing causes such as age, sex, poor hygienic condition and state of nutrition and then discusses the theories of different authors as to the immediate causes, and after considering them comes to the conclusion that the cause of intestinal invagination is a change in peristalsis resulting from excessive local stimulation due to various causes, such as tumors, foreign bodies, etc., which act upon and change the innervation of the intestine. The symptoms are not characteristic nor are they the same in all cases so that diagnosis is rather difficult by clinical methods, and for that reason roentgen examination is very important and often decisive. Therefore patients who present themselves with rather indefinite gastrointestinal symptoms should be examined roentgenologically and further cases collected for a study of this condition.

BALDONI, GIUSEPPE. Double mediastinal hernia in the course of an artificial pneumothorax. *Radiol. med.*, October, 1924, xi, 620–624.

A patient was treated by artificial pneumothorax for a tuberculous infiltration of the left lung. In the course of the treatment a double mediastinal hernia developed. There was a pleural effusion which passed from the pneumothorax cavity to the hernia and vice versa, depending on the position in which the patient lay. The author succeeded in reducing the hernia completely by decreasing the high pressure of the pneumothorax. He describes the way in which mediastinal hernias are formed. There are points in the mediastinum which are weak anatomically and yield readily to high pressure on one side. One of them is in the upper part of the thorax extending from the attachment of the first rib to the lower margin of the third, in front of the large vessels. The other is behind between the heart and the spinal column. If in addition to these points of anatomical low resistance there is a pathologically decreased resistance due to a serous infiltration of the pleura, which is often found in old pneumothoraces, hernia may readily develop. To prevent such an occurrence it is necessary to follow up the course of an artificial pneumothorax roentgenologically, particularly with regard to the development of effusion.

BECCHINI, GASTONE. Traumatic spondylitis. *Radiol. med.*, February, 1925, xii, 86–89.

The patient was a woman of fifty-five who had always been well, although she came of an arthritic family, and had never had any acute or chronic infectious diseases. She fell on her left side and felt a violent pain, "as if something had torn." She was in bed for two months and after that had attacks of pain, especially in the hip on movement of the left leg, and rigidity of the lower part of the lumbar spinal column gradually developed, though there was no special pain on palpation. After about a year she fell again, this time on her back, and the symptoms grew somewhat worse. A roentgenogram showed a slight deviation of the last lumbar vertebra to the right and of the sacrum to the left, so that the longitudinal axes of these two segments formed an angle open to the left. There were two osteophytes, one on the lower margin of the last lumbar vertebra and one on the upper margin of the first sacral vertebra, both directed toward the left and coming together at their ends. The author believes this was a case of traumatic spondylitis though some authorities are inclined to question the possibility of osteophytic spondylitis from trauma alone. But he cites as evidence the strict relationship between the time of the fall and the beginning of the symptoms and the fact that there were no other bone changes anywhere, while arthritic osteophytes are ordinarily multiple. Moreover while the patient was of an arthritic family she had never had signs of arthritis herself, nor had she ever had any of the infections which ordinarily cause spondylitis.

BIANCHINI, A. The value of roentgen examination in the diagnosis of multiple myelomata of bones. *Radiol. med.*, March, 1925, xii, 140–158.

This disease was first described by Kahler in 1889 and is known as Kahler's disease. The author describes in detail a case in a woman aged forty-four. She was sent for roentgen examination because of an apparently spontaneous fracture of the femur and the plate showed an abnormal transparency of both fragments, but especially the distal one; there was also erosion of the compact tissue so that the cortex was reduced in places to a very thin layer. This abnormality of the bone at the site of the fracture and the severe pain of which the patient had complained led the author to make examinations of other parts of the body on the theory that it was a general and not a local disease and he found multiple bone tumors, the bone showing the same picture at all the different sites. He describes 4 stages in the roentgen picture of the disease: (1) there are one or more round or oval foci clearly circumscribed, the size of a lentil or less, limited apparently to the marrow of the long bones or the spongy portion of the flat ones. These foci are more transparent than the surrounding

tissue. This period corresponds to the clinical stage of intermittent pain. These foci may be found in any of the bones but are especially frequent in the ribs, clavicle and sternum. (2) There are numerous transparent foci sharply circumscribed of different sizes, but larger than a large pea, which often have become confluent. These are still in the center of the bone but show a tendency to extend to the periphery. This is the clinical period of severe continuous pain and the beginning of deformity from weakness of the bones. (3) In this phase the transparent foci have become fused and form a large focus which has attacked the compact bone and is rapidly approaching the surface. The cortex may be very thin in places. The palpation of these foci may show a parchment crackling. This is the period of maximum deformity and curvature of the body. (4) The cortex at some points is reduced to a very thin layer; at other points there may be fractures or the cortex may be entirely broken down so that the myelomatous tumors protrude. The periosteum however is generally preserved and covers the tumors. At this stage there may be slight atrophy of the bone, but it is not always present. On palpation there is parchment crackle. It corresponds to the period of spontaneous fractures and tumors that are visible objectively.

Prominent clinical characteristics are the presence of Bence-Jones albumin bodies in the urine, the fact that it occurs only rather late in life, is always fatal and never causes metastases in other organs.

Bracaloni, Enrico. Study of variations in the roentgenogram of the sacrolumbar region. *Radiol. med.*, November, 1924, xi, 661–683.

There are considerable differences in the roentgenograms of the sacrolumbar region in different individuals. Bracaloni studied the causes of these differences by means of tracing on the different roentgenograms a trapezoid the top of which is formed by a line passing between the highest points of the crests of the ilia, the base by a line parallel to the first passing through the highest median point of the sacrum and the sides by two lines tangent to the crests of the ilia and cut by the two abovementioned parallel lines. The fifth lumbar vertebra is found in the middle of this trapezoid, resting on the sacrum. In the different roentgenograms the base and top lines are at varying distances from each other and the two side lines present varying degrees of obliquity. A study of the roentgenograms shows that the differences are not due to any morphological differences in the bones themselves but to different positions which the bones of the pelvis may take within certain limits, in different individuals, which are brought about by a complex movement of the sacroiliac joint. A plate is given showing the different positions which the sacrum may take as a result of these movements. The different appearances of the roentgenogram are due: (1) to a greater or less distance of the crests of the ilia from the base of the sacrum; (2) a greater or less elevation of the fifth lumbar vertebra between the two iliac bones, and (3) differences of obliquity of the fifth lumbar vertebra itself with relation to its frontal axis. These variations, which are considerable in degree in the different roentgenograms, are produced with perfect correlation because they are the effect of a complex but definite movement. Examination of the roentgenograms shows that a very open angle of incidence of the crest of the ilium with relation to the base of the sacrum corresponds to a greater height of the fifth lumbar vertebra between the two ilia and a lesser forward obliquity of this same vertebra, and that conversely with a lesser angle of incidence there is a deeper position of the fifth lumbar vertebra between the two iliac bones and a strong forward obliquity of the vertebra. There are of course all intervening stages between the two extremes.

Chizzola, Giuliano. Avulsion fractures. Importance of the roentgen picture in their diagnosis and treatment. *Radiol. med.*, December, 1924, xi, 767–782.

These are fractures in which one or more bits of bone have been torn off by the action of ligaments or tendons. They are frequently associated with luxation. It is often a lesion that is not very important from an anatomical point of view but very important from a functional one, especially where the fracture involves a joint, as it frequently does. These lesions have no specific clinical symptoms and therefore the roentgenologist very frequently does not have an opportunity to make an examination of them until some time after the injury; very often the physician who treats the injury diagnoses them as contusion or distortion and does not think of having an examination made. Yet it is very important that they be correctly diagnosed, especially in cases of industrial accident where the question of damages is involved. Often the patient himself comes to the roentgenologist complaining that the pain of the old wound has persisted or even grown worse. The only way of localizing the lesion exactly, estimating its severity and prescribing treatment is by means of roentgen examination. Often of course the only possible treatment is surgical. Undoubtedly in all cases

of lesions of bones and joints roentgen examination should be made as early as possible in the interests of both the patient and the physician. In making his diagnosis the roentgenologist must always take into consideration the possibility of post-traumatic ossification, centers of ossification and supernumerary bones. There are twenty-seven roentgenograms showing such fractures in various locations.

COLOMBINO, CARLO, and PERUSSIA, FELICE. Roentgenography of the bladder in gynecology. *Radiol. med.*, December, 1924, xi, 757–766.

Twenty roentgenograms of the bladder are shown of the changes in form and position of the female bladder caused by the different stages of pregnancy and by tumors of the uterus and adnexa. The authors used milk of barium (barium sulphate) which was very well borne. They found that the axial posteroanterior caudo-cranial projection was one of the most useful in this work as it shows the amount of posteroanterior compression to which the bladder is subjected with increase in size of the pregnancy or tumor.

GHERARDI, BRUNO. A case of mediastinal pleurisy that was hard to diagnose. *Radiol. med.*, October, 1924, xi, 606–609.

A patient, aged twenty-seven, after hard farm labor noticed a swelling in the left supraclavicular fossa and at the same time dyspnea and dry cough began; slight fever with morning remissions, pain in the precordium with radiation to the left and dysphagia; neither singultus nor vomiting; phonation regular. Objective examination showed slight turgor of the vessels of the neck; respirations small and frequent but rhythmical. In the left supraclavicular fossa there was a swelling the size and form of an egg enclosed by two swollen glands. There were no palpable glands elsewhere in the body. On percussion there was a large zone of dullness that surrounded the cardiac dullness, surpassing it by some centimeters and which remained fixed in all positions of the body. At both bases there were decreased breath sounds and vocal tactile fremitus with bronchial respiration. Roentgenoscopy with hard rays showed in the midst of the round median shadow which corresponded to the zone of dullness, a more opaque zone on the left with clear outlines and regular pulsation which corresponded to the normal cardiac area. There were two possible diagnoses: tumor of the mediastinum and pseudo-pericardiac mediastinal pleurisy. Arguments in favor of the first were the supraclavicular adenopathy and a certain irregularity in the outline of the shadow of the left hilus. But a strong argument for the second was furnished by an opaque transverse stripe slightly oblique from above downward and from without inward which divided the whole width of the right thorax at its lower third, a finding common in interlobar sclerosis. It was decided to give the patient a deep roentgen treatment for diagnostic purposes and he was irradiated as follows: anterior thoracic field 18 × 18 cm., 40 cm. focus-skin distance, diapositive of Warnekros, neo-reform apparatus 3 ma., 200 kv., filter 0.8 copper, 1 mm. aluminum and celluloid; one skin erythema dose (62 minutes); posterior thoracic region field 18 × 18, focus-skin distance 30 cm., skin erythema dose 35 minutes, thus giving a dose of 62 per cent on the anterior mediastinum and 48 per cent on the posterior mediastinum. The patient bore the irradiation well and was able to return home but shortly afterward he vomited a large amount of whitish fluid and expectorated a foamy liquid, with intense cough and dyspnea for two days accompanied by high fever. When he returned four days later he was much better and the supraclavicular swelling and the retrosternal dullness had almost entirely disappeared. He gained rapidly in weight but after about two months returned to the hospital with considerable swelling of the lateral cervical and supraclavicular glands and a pleural effusion on the left. Exploratory puncture gave about 10 c.c. of serofibrinous fluid containing lymphocytes, some polynuclears and some epithelial cells.

Large peri-pericardiac mediastinal effusions, which are quite rare, should be suspected in cases in which there is an irregularity of the shadow in the hilar and interlobar regions. The roentgen treatment in this case was given on the supposition that it might be a mediastinal tumor and its success was due rather to chance than to the direct action of the rays.

GHERARDI, BRUNO. Two cases of stenosis of the colon of different etiology but with similar symptomatology. *Radiol. med.*, November, 1924, xi, 689–695.

In both these cases there was abdominal pain at irregular intervals and alternating periods of diarrhea and constipation. The first patient was a man of sixty-two in whom physical examination was negative. On roentgen examination the ascending colon and the first two-thirds of the transverse were filled within six hours of giving the barium meal. At this point however its progress was stopped by a stenotic ring with a regular margin and without any deformity of the wall. After thirty hours the intestine beyond this point still showed only slight traces of barium but was

distended with gas. On operation the stenosis was found to be due to adhesions which constricted the left part of the transverse colon. There were also peri-appendicular adhesions from an old appendicitis and a large calculus in the gall-bladder. After operation the patient was restored to perfect health and regained his former weight. The second case was in a woman of forty-two with clinical signs similar to those of the first case. She also presented great emaciation in addition to the intestinal symptoms. She was a slender and nervous woman and her intestinal symptoms were aggravated by irregularities in diet and by psychic disturbance. Roentgen examination showed normal stomach and small intestine, but a few centimeters from the hepatic flexure of the colon there was an annular stricture about a centimeter long. This was followed by a tract of normal intestine and then by a second and a third stricture. These strictures were evidently due to a change in the intestinal wall, possibly caused by multiple tuberculous ulcers, though some of the symptoms were lacking, such as the preferred localization at the cecum and ileocecal valve and absence of Stierlin's sign (defective filling of the injured tract with the opaque salt and irregular marmorization due to a fine deposit on the ulcerated mucous membrane). But Stierlin's sign is not always present and the pathological part of the intestine is sometimes seen, as in this case, distended with gas from increased decomposition of its contents. This patient was sent to the Riviera and under special diet and general strengthening treatment is improving gradually in general health, and the intestinal condition is also improving.

GIONGO, FRANCO. Comparison of the roentgen appearances of some forms of epiphysitis. *Radiol. med.*, March, 1925, xii, 109–140.

A number of authors who have studied the changes which occur at the boundary between bone and cartilage during the period of their most intense development—the so-called growth epiphysitis—agree that the process is the same no matter what its site. Zaaijer thinks that it consists of a disturbance of chrondral ossification with abnormal and excessive proliferation of cartilage cells, a sort of swelling of the cartilage at the expense of the center of ossification as a result of which the latter remains small and is disturbed in structure and in the process of calcification.

The author has made a roentgen study of such cases and gives roentgenograms of the malady appearing in various parts of the body, in the hip, the lower part of the radius, the tibia, the scaphoid, the metatarsals and phalanges, the calcaneus, the vertebrae in children, the crest of the ilium and the ramus of the pubis. In all of these he finds increase of the cartilage at the expense of the bone, calcareous deposits and frequently osteophytes. The deformities which result vary, depending on the static-dynamic functions of the region affected. They are most intense in regions subjected to traction, pressure, concussion or bruising. This shows the importance of early recognition of the process and of protecting the part from such influences. It must be studied chiefly by means of roentgen rays as it tends to spontaneous recovery so there is no opportunity for histological examination. The roentgen picture shows change not only in the epiphysis but also in the metaphysis and therefore the author calls the condition meta-epiphysitis.

A very extensive bibliography of the subject is given.

LUPO, MASSIMO. Anomaly of esophageal deglutition from disturbance of balance between the vagus and sympathetic. *Radiol. med.*, April, 1925, xii, 244–258.

By the use of an opaque bolus the author studied paradoxical deglutition in a number of patients with Basedow's disease, aortitis and gastric ulcer. This phenomenon consisted in the bolus stopping in the midst of the esophagus—not at the physiological constrictions—while liquid passed freely, not even being interfered with by the presence of the bolus which remained motionless while the liquid passed. This phenomenon is a sign of hypotonia of the esophagus, as the author was able to show by reproducing paradoxical deglutition on the cadaver.

He thinks that in the cases which he observed the hypotonia of the esophagus was due to a disturbance of vago-sympathetic equilibrium. The exaggeration of sympathetic tonus which has been observed in patients with Basedow's disease may produce a relative hypotonus of the vagus which would result in this disturbance of esophageal function. The author has proved the correctness of this theory by producing the phenomenon of paradoxical deglutition in normal subjects by adrenalin stimulation of the sympathetic. He thinks from these facts that study of the function of the esophagus may give valuable information in regard to the condition of balance between the vagus and sympathetic.

MOGI, BRUNETTO. The significance of premature calcification of the first costal cartilage. *Radiol. med.*, February, 1925, xii, 79–84.

Freund in 1859 found that stenosis of the upper opening of the thorax is a part of the tuberculous habitus. This stenosis is for the most

part due to premature calcification of the first costal cartilage and Freund attributes this premature calcification to an arrest of development due to infantilism. But Käding has recently attributed it to lesions at the hilus which he holds have an effect on the deposition of calcium in the costal cartilages.

From a study of about 600 roentgenograms of the thorax the author comes to the following conclusions:

(1) In normal individuals the roentgenogram shows marked calcification of the first costal cartilage from thirty-five years of age on, but rarely before that age.

(2) In subjects with pulmonary tuberculosis it is often found at an earlier age but never before nineteen.

(3) Even subjects who at the time of examination do not have any pulmonary lesions that can be demonstrated clinically or roentgenologically may show a process of calcification of the first costal cartilage, which in all probability indicates a predisposition to pulmonary tuberculosis.

(4) This premature calcification must be attributed to a condition of infantilism.

(5) Roentgenological demonstration of premature calcification of the first costal cartilage may in some cases be useful in prognosis and in others it may aid in early diagnosis.

PERONA, PIETRO. Fracture of the rim of the acetabulum following subluxation of the hip in a patient with coxitis. *Radiol. med.*, November, 1924, xi, 696–698.

The patient was a boy, aged twelve, with coxitis in whom roentgen examination showed subluxation of the right hip and a very unusual finding consisting of a fracture of the rim of the acetabulum. It differs from the cases previously described in the literature in that there was no history of trauma. The author thinks that the fracture was not sudden but was brought about gradually in the course of the development of the tuberculosis of the hip. This theory is supported by the fact that the rim of the acetabulum had become adapted to the head of the femur. Moreover as the patient was young and the bones which enter into the formation of the acetabulum had not yet become completely fused fracture was easier.

NICOLIS, STEFANO. Calcification of the subacromial bursa. *Radiol. med.*, October, 1924, xi, 638–640.

This condition is characterized by pain on pressure immediately external to the acromion process, pain on maximum abduction of the arm and on roentgenological examination an oval shadow between the acromion and the tuberosity of the humerus. A case is described in a peasant woman, aged thirty-eight, who in 1916 after a severe wrench of the right arm had pain in the arm increased on movement. It gradually subsided and she was able to continue her work. But in the winter of 1922–23 after unusually heavy work the pain returned and was more severe and persistent than at first. Roentgen examination showed a shadow at the site of the subacromial bursa and an incision was made and the bursa removed. It was found to be calcified. Complete recovery occurred in twelve days. A probable diagnosis of this condition can be made clinically but it must be confirmed by roentgen examination before operation is performed.

PENNETTI, G. Changes in the neutrophile leucocyte count caused by the action of roentgen rays. *Radiol. med.*, January, 1925, xii, 10–20.

The experimental results obtained by the author may be summarized as follows:

An hour and a half after irradiation with a dose of 3 to 5 H, filtered through 0.5 mm. aluminum, there is a considerable lymphopenia with deviation to the left of Arneth's scheme, accompanied by a decrease in the total count. The maximum intensity of these changes is reached in the fourth hour. The next day they begin to recede and by the third day the count has become normal, or there may even be a little deviation of the Arneth scheme to the right. The same results, but more rapid and more durable, may be obtained by giving half an erythema dose or even a full erythema dose with a 0.5 mm. zinc-aluminum filter with an apparatus for deep roentgen treatment. These facts are explained by the different biological action exercised on different tissues by roentgen rays, which, with the same doses produce necrosis of the circulating blood cells while on the contrary they stimulate the function of the blood-forming organs.

PIRANI, GIANNI. Lipiodol in the roentgen diagnosis of pulmonary tuberculosis. *Radiol. med.*, April, 1925, xii, 222–242.

The use of lipiodol as a contrast medium for diagnosis of pulmonary conditions was first reported in March, 1922 and since then a number of authors have studied its use. A bibliography of the subject is given. The author used it to study some of the most characteristic pictures presented by pulmonary tuberculosis. He administered it through the glottis after careful cocain anesthesia of the pharynx, larynx and trachea. The opacity of the bronchi brought about by the use of the iodized oil made it possible to observe in the living subject the anatomical arrangement of the

bronchi as well as the effects of attacks of coughing and of pulmonary ventilation. He also made a special study of bronchiectases which he says are much more frequent than they are revealed to be by ordinary methods of diagnosis and which can be demonstrated very well by means of lipiodol; of pseudo-cavities which are also revealed clearly by the use of lipiodol; of therapeutic pneumothorax the physiopathology of which can be studied much more easily by observation of the anatomical condition of the bronchi than by the usual roentgen method; and of the large field of hilus shadows and the lung outline which, though undoubtedly due for the most part to the vessels, nevertheless take on quite varied appearances under pathological conditions which are very hard to interpret by the direct method, while they can be much more easily diagnosed by means of lipiodol contrast.

The author has never observed any bad effects in any of the many cases in which he has used this method. There is no serious technical difficulty in using it. Its use is contraindicated in all inflammatory conditions of the upper respiratory passages, in Basedow's disease, in patients who do not tolerate iodine and in patients with hemoptysis. But in spite of these contraindications it is an excellent method and the author hopes its use will become current in roentgenology.

Riccitelli, L., and Bellucci, B. Clinical and roentgenological study of displacement of the heart in tuberculous lesions of the lungs. *Radiol. med.*, January, 1925, xii, 1–9.

A clinical and especially a roentgenological study of displacements of the heart in patients with tuberculous or non-tuberculous cavities, and in infiltrations or processes resulting from them shows that in old cases there is frequently traction of the heart toward the side of the oldest lesion. As there are roentgenological signs of bands pulling on the pericardium and sometimes surrounding it completely, producing an abnormal displacement of the heart, it would seem that the displacement is caused by the inflammatory process becoming propagated to the pleura and from there by contiguity to the pericardium, and that displacement is not brought about until the infiltration of the parenchyma or of the zone around the cavity reaches the surface. The more intense and the more widely diffused the infiltrative process, the greater the displacement of the heart. Sometimes it is drawn entirely over to the other side of the thorax when the traction is on the right side.

In view of the frequency with which this condition is found in tuberculous lesions, especially on roentgen examination, it should be given the attention it deserves. It gives information as to the activity and extent of chronic inflammatory processes, and as to the cause of abnormalities in the hydraulics of the heart and lesser circulation, and after a roentgen examination this state of affairs should be taken into consideration in the prognosis. It is obvious that the lesser circulation which has already been disturbed by the lung process will be still further deranged by the new conditions brought about by the changed topography of the heart and that this added pathological factor may be quite serious. In this way the heart lesion and the pulmonary lesion come to form one of those vicious circles which are so frequent in pathology and to which physicians in general do not attribute as much importance as they deserve although the idea of the vicious circle is a very ancient one.

Pirazzoli, Arrigo. Unusual cases of solitary exostosis. *Radiol. med.*, November, 1924, xi, 684–689.

Multiple cartilaginous exostoses are commonly believed to be due to endocrine influences but there is still considerable difference of opinion as to the etiology of solitary exostoses of bone. Pirazzoli reviews the experimental work done by various authors on the subject of the transformation of transplanted connective tissue into cartilaginous or bony tissue and describes 2 cases of solitary exostosis of the lesser trochanter, both of which developed very slowly and gradually, and finally became calcified. He accepts the hypothesis which seems to be most generally accepted as to their origin, namely that they are due to an abnormality of development in the center of ossification of the lesser trochanter which is one of the latest centers to develop and to become fused with the rest of the bone. They may develop in other locations from proliferation of an island of cartilage in the epiphysis.

Sessa, Piero. Roentgen study of primary malignant neoplasms of the lung. *Radiol. med.*, March, 1925, xii, 159–180.

Two cases of carcinoma of the upper lobe and 2 cases of sarcoma are described and roentgenograms presented. For purposes of differential diagnosis 2 cases of metastatic tumor of the lungs and 2 of tuberculosis are described and illustrated. Some points in the differential diagnosis are discussed but Sessa concludes that it is often impossible from the roentgen picture alone to make a differentiation between primary tumors and various inflammatory conditions of the lungs and that the clinical evidence must always be carefully

weighed also in making a decision. He does not believe it is possible to differentiate between different kinds of neoplasm originating in different parts of the lung from the roentgen picture of the fully developed tumor, as some authors have suggested.

ZACCARIA, A. A. A case of megacecum. *Radiol. med.*, February, 1925, xii, 85–86.

A student, aged twenty-five, had vague dyspeptic symptoms, abdominal pain accompanied by a feeling of fullness and weight in the stomach, meteorism and chronic constipation, as well as more or less marked signs of stercoremia. Roentgenological examination showed a very large cecum, the roentgenogram of which is reproduced; operation confirmed the roentgen findings. The cecum was three times as large as normal and pericolitic bands ran over its surface. The appendix was back of and inward from the cecum and was adherent to the end of the ileum, making a sort of bridge. The appendix was removed and cecoplication performed, the two longitudinal teniae being united. The patient was dismissed in two weeks and is now so much improved that complete recovery is to be expected.

ZACCARIA, A. A. Fracture of lumbar spinous processes by violent contraction of the muscles. *Radiol. med.*, January, 1925, xii, 21–22.

Kryger found that by forced extension of the spinal column in the cadaver he could frequently bring about fracture of the lumbar spinous processes. Zaccaria describes the case of a workman who was attempting to set up a ladder to make some repairs on the telephone line when the base of it slipped and its weight fell on his arm, bending his body far backward. By violent muscular effort he was able to keep his feet, and his comrades lifted the ladder. He had severe pain in the lumbar region radiating toward the sacrum, and difficulty in walking. After a few days he had slight fever, headache and sweating during the night. Roentgen examination showed a comminuted fracture of the spinous processes of the 4th lumbar vertebra. After two weeks of rest he was able to resume his work.

ROENTGEN AND RADIUM THERAPY

BIOGLIO, MARIO AUGUSTO. Statistics and technique of radium therapy. *Radiol. med.*, July, 1924, xi, 421–430.

The author discusses his experience in radium therapy for the past ten years. He has had at his disposal 278 mg. radium element distributed in 42 apparatus of different forms and strengths standardized at the Cuier Institute in Paris or the Geiger Institute in Charlottenburg. Generally he has applied the apparatus directly *in situ*, with an effort to obtain the best superficial and deep results by the cross method of Degrais. He has sometimes used Dominici and Régaud tubes and needles of gold or platinum; he has also used other special methods which he proposes to discuss more in detail in special reports.

In diseases of the skin he had the best results in lupus, psoriasis and eczema. He gives large doses without filtration. In tumors the best and most durable results were obtained in sarcomas, among which those made up of small round cells with little or no stroma are cured most quickly. Sometimes the disease develops very readily again at the same place or elsewhere and the patient finally dies of it. In certain cases injections of soluble salts of radium are very useful. In carcinoma it sometimes happens that after a single large dose with strong filtration the tumor seems to be reduced and rendered mobile. The physician must guard against being too much encouraged himself or allowing the patient to be so, for in general it is the defense tissue around the tumor that yields first rather than the tumor itself, and the patient should be urged to submit to operation which can now be performed in sterilized tissue.

DE BACKER. The radium-roentgen-surgical treatment of cancer of the breast, *Progrès méd.*, 1924, No. 35, 522–524.

Cancer of the breast is usually removed by surgical intervention if it is possible. In instances in which the subject objects to removal of the breast, radium and roentgen treatments are used. Roentgenotherapy is, therefore, limited to such cases as are inoperable and those in which the patient objects to removal of the breast. In the latter cases, treatments are often continued for three to four years and surgical operation is delayed thereby. Radium puncture is resorted to, and injection of electrocolloidal substances abandoned. After removal of the breast, radium tubes are placed in the suture; the sutures heal well, and the tubes are removed later without difficulty. Preoperative irradiation is not recommended for various reasons. Postoperative irradiations, however, are of undoubted value. The gamma rays of radium exert a more selective action on the cancerous cells than the roentgen rays. At the time of operation, two tubes of 3 cm. length containing 25 mgm. of radium, filtered through 2 mm. platinum, 0.1 mm. aluminum and 3 mm. rubber, are placed in the sutures

after operation. When the wound is firm, roentgen treatment is started (40 cm. spark; filter, 0.5 mm. zinc plus 1 mm. aluminum; focal distance, 30 cm.; 3,000 to 4,000 R per field). The depression above and below the clavicle is irradiated. A high percentage of cures have been secured in this way.

CAMPLANI, MARIO. Treatment of tinea with roentgen rays. *Radiol. med.*, June, 1924, xi, 378–381.

This article emphasizes the excellent effects of roentgen rays in the treatment of mycoses of the scalp and points out that these good results can be obtained with even very modest roentgen apparatus. Results of roentgen epilation are reported in 130 cases; 69 of the patients were males and 61 females, and they ranged from two and a half to twenty years of age. With good fixation of the head there is no contraindication to the use of the treatment even for very young infants. The cases included 114 of torpid trichophytosis, 2 of microsporia, and 14 of tinea favosa. There were no immediate or late bad effects in any of the cases; the hair fell out and grew in again within the usual limits of time. The patients can be treated outside the hospital.

The head was divided into fields and irradiated according to the method of Adamsom-Kienböck. The author used rays of moderate intensity, unfiltered, with a hardness of 6 to 7 Benoist with a focus skin distance for tubes of 125 mm. or 15 cm. He gives a warning against increasing the intensity of the rays in order to shorten the time.

DUBREUILK, W., AND DAVID-CHAUSSÉ. Radiodermic ulcer. *Ann. de dermat. et syph., Par.*, 1925, 6. s., vi, 161–169.

There are two types of radiodermatitis, acute and chronic. The chronic type is caused by an accumulation of small doses of the roentgen ray over a period of years, the symptoms being pigmentation, hyperkeratosis, epitheliomas and probably neuritic ulcers. Acute radiodermatitis is caused by excessive irradiation with strong doses of the roentgen ray repeated at short intervals. The symptoms are in the nature of a burn, often becoming apparent two weeks following application of the rays. A characteristic scar is left. After apparent cure, the ulceration may return either spontaneously or due to traumatism; all the characteristics of the original ulcer, even after the lapse of several years, accompany the new ulceration. One case has been reported as occurring after a period of twelve years. Two cases of radiodermatitis are here reported in which there was a recurrence of the ulcer after apparent cure. One, a rodent ulcer, was treated and cured by a single application of the roentgen ray, 6 H unfiltered. However, a slight radiodermatitis resulted; this was treated from time to time, but it always recurred, even after ten years. The second case had a recurrence of radiodermatitis nine years after the last irradiation for fibroma of the uterus. These ulcers were the same in every way as the original ulcerations.

HUDELO, LAPORTE, AND KOURILSKY. Generalized acute lichen planus developed in the course of a roentgen treatment of discrete lichen planus. *Bull. Soc. franç. de dermat. et syph., Par.*, 1925, xxii, 6–9.

The use of roentgenotherapy in the treatment of lichen planus has been established as being in most cases very advantageous. A case is reported here in which an unusual complication followed such treatment. The eruptions of lichen planus treated were on the left side, left breast, etc. Irradiation of the cervico-dorsal and dorso-lumbar regions of the spinal column was made as follows: 3 H in each field, spark equivalent to 23 to 24 cm., filtration through 10 mm. aluminum. No untoward symptoms were noted until after the fourth day, after which time a definite cutaneous reaction developed. Ten days after the first irradiation, a similar treatment was given. Four days later the skin over the whole body showed general erythema; the patient lost her appetite and suffered loss of weight. The blood was normal, as well as the liver and spleen. Biopsy confirmed the condition to be acute lichen planus. After placing the patient on a vegetable diet and administering sodium hyposulfite and using a menthol-camphor paste, the symptoms were ameliorated considerably. The authors believe that the patient will recover entirely within a short time. This result is not sufficient to stop the use of roentgenotherapy in the treatment of lichen planus, but a warning is given.

JOLY. Outline of the technique of roentgenotherapy of deep tumors. *Progrès méd.*, 1924, No. 21, 317–318.

For the treatment of deep tumors, short wave lengths of high voltage are found to be most advantageous. Between the anticathode and the skin a screen of metal (copper, zinc, or aluminum) is used as a filter to absorb the long and medium-length waves; the short waves are not checked and enter the skin and deeper tissues unchanged. The quantity of roentgen ray given is gauged by an ionometer. Diagrams are given showing the areas to be treated for various deep tumors; a definite

scheme of such treatments is necessary in order that the most effective treatment be administered, a diagram being followed in which the points of administration are definitely indicated. In some cases, the roentgen treatment is followed by radium. Diagrams of treatment of cancer of the rectum is given with cure. In another, cancer of the cervix of the uterus was treated with favorable results without affecting the bladder or the rectum. Another cancer of the uterus was similarly treated without affecting the surrounding organs. No detailed outline is given in the treatment of these three cases, the exact technique being that commonly used. The diagrams are rather self-explanatory and illustrate the need for such a guide.

LEGUEU. The limits of electrocoagulation. *Progrès méd.*, 1924, No. 17, 264–265.

This is a general discussion of the advantages of electrocoagulation in the treatment of tumors of the bladder. In the first place, the use of a current of 250 to 300 ma. is sufficient to cause a coagulation of the albumins of the tumors without burning or leaving a scar. The tissue is destroyed with a minimum of pain and without hemorrhage. Two or three points of the tumor may be treated at the same time, and a single treatment may take but 5 to 10 minutes, according to the tolerance of the patient. For destroying a tumor the size of a small nut, two or three treatments are sufficient; an interval of 18 to 20 days is most favorable. Cancers and benign papillary tumors of the bladder have been very successfully treated in this way. Electrocoagulation is advisable in all cases; those situated in the anterior wall of the bladder are especially difficult to treat and offer considerable danger to the surrounding tissue, the urethra especially. Large tumors likewise are not to be treated in this way; multiple tumors also are not apt to respond satisfactorily. The number of treatments necessary in such cases is the factor of most importance. The method has great possibilities, but the contraindications must be recognized.

LORTAT-JACOB, LEGRAIN, and COTTENOT. Multiple osteosarcoma of the cranium and maxilla. Case showing actual cure by means of roentgenotherapy. *Bull. Soc. franç. de dermat. et syph., Par.*, 1925, xxxii, 18.

The case reported here had osseous tumors in the frontal region of the cranium and of the inferior maxilla. These were quite large, and there were some smaller swellings. The roentgenogram confirmed the diagnosis, showing the tumors as large clear spaces with irregular contour. The following treatment was used: 200,000 volts; focal distance, 40 cm.; filtered through 0.5 mm. zinc and 1 mm. aluminum; irradiations were made in two large lateral fields, embracing the whole profile of the cranium and face. Each field received a dose of 2,000 R; a total dose of 4,000 R was given in four days. Complete cure of the lesion resulted. The roentgenogram then showed the clear space to have entirely disappeared and the image was that of a normal cranium with regular contour.

MALLET, LUCEIN, and COLIEZ, ROBERT. Technique of deep curietherapy at great distance and crossed fire on separate fields and localities. *Bull. Acad. de méd., Par.*, 1925, 3. s., xciii, 146–149.

A technique is described by means of which a greater intensity of irradiation may be applied to deep tissues without subjecting the skin to injury which would ordinarily result by the direct application in one place of concentrated rays. The apparatus consists of a curved holder in which the radium is held in the proper tubes and placed in such a way that the rays will converge at a certain point, according to the depth of the tumor, beneath the skin and directly on the tissue to be destroyed. Five tubes are so placed and directed in such a way that their rays will converge at the desired point; depths of even 10 cm. can be so treated. A relatively greater distance from the skin is necessary, and the tubes are protected with lead so that the rays will not concentrate to any extent on the skin and cause burning. By this means, many tumors are reached which are inaccessible by any other means. Cancer of the esophagus is better and more completely irradiated; cancers of the uterus, rectum, stomach, etc., are destroyed by this means more readily than by any other. This technique increases the possibilities of curietherapy.

MINO, PROSPERO. Roentgen rays in the treatment of hemorrhage. *Radiol. med.*, February, 1925, xii, 64–78.

Acceleration of the coagulation time of the blood can be brought about by irradiating different parts of the body with roentgen rays provided they are well supplied with blood. The result is positive in the majority of cases but not in all, and its duration varies in different individuals. The effect of the rays is not due to their exercising any special action on the functions of the spleen, liver or other organs but to their directly changing the physico-chemical condition of the blood.

The hemostatic effect in cases of traumatic hemorrhage or hemorrhage due to lesions of the

vessels as a result of morbid processes such as hemoptysis, ulceration, tumors, etc., and in uterine hemorrhage from different causes is variable, but there is often a positive action. The results have almost always been positive in hemorrhage in true hemophilia and the same is true of certain mild forms of secondary hemorrhagic purpura, but positive and durable results have not been attained in idiopathic hemorrhagic purpura (Werlhof's disease).

This method used for preventive purposes before surgical operation has only given results which are negligible for practical purposes except in cases where coagulability is abnormally low. But even with these limitations roentgen rays should be more widely used than they are for hemostatic purposes, and a more careful study should be made of just what they can be expected to accomplish and what they cannot. The number of hemostyptic agents is not so great nor their action so certain that any method can be rejected which offers any prospects of success in controlling hemorrhage. The author thinks the practical utility of this method should be studied by using it along with other agents which are in current use for controlling hemorrhage such as calcium chlorid, serum, gelatin, adrenalin, pituitrin, etc., each of which when used alone has proved incapable of giving satisfactory results.

NATALE-MARZI, PAOLO. Results of treatment of skin epitheliomas by silver iontophoresis and roentgen irradiation. *Radiol. med.*, October, 1924, xi, 624–637.

Case histories and photographs are given of 14 cases of skin epitheliomas treated by silver iontophoresis (0.5 per cent protargol) and roentgen irradiation. The focus-skin distance was 30 cm. and the filtration and irradiation time were variable. The treatment was effective in the majority of cases whether ulcerated or not. Cure was brought about in baso-cellular as well as spino-cellular forms. The radiosensitiveness does not seem to depend solely on the histological structure. When the best technique is found the resistance to treatment seems to depend on the reactive capacity of the tissues on which the neoplasm has developed. This reactive capacity may be influenced by the age of the patient, other diseases such as diabetes or arthritis, by changes brought about in healthy tissue by the duration of the lesion, its extent and site and by physical or chemical treatments which have been used. The action of iontophoresis was found to be due to the secondary rays produced in the tissues, which if used alone have a disinfectant action on the ulceration but leave the cancer cells unaffected. Very small doses were found to be insufficient or even stimulating while intense doses with a single filter were less energetic in action than those with a variable filter.

MISCELLANEOUS

CURIE. The preparation of radioelements little used in medicine up to the present time. *Bull. Acad. de méd., Par.*, 1925, 3. s., xciii, 417–422.

Radioactive substances are first discussed from the standpoint of their wave length and effectiveness in therapy. The three kinds of rays, the alpha, beta and gamma, are described as to their usefulness; the alpha rays are more absorbable, the beta rays more penetrating, and the gamma rays are still more so. The method of using, both externally and internally is mentioned. The time period of the effectiveness of certain radioelements is of much importance; uranium X is effective for about twenty-four days. Ionium is found in much larger quantity than radium and emits the gamma rays. A mixture of ionium-thorium is possible, but is not made commercially. A radioelement called radon is now made commercially. Radium D is a mixture of radium and lead and is a by-product of the production of radium. It is of little importance except as source of radium E and polonium. The methods of extracting these products are mentioned. The processes of production of the thorium are also discussed. This seems to be more of a review of previous work and the industrial production of radioelements than a report of new work. However, certain phases of original work are touched upon, for example, work on actinium X and radio-actinium and further work on thorium X.

DAZZI, ANGELO. Study of the morphological changes in the blood following irradiation of the region of the spleen with the so-called stimulating dose. *Radiol. med.*, September, 1924, xi, 529–558.

The theory has been accepted in radiotherapy that small doses of rays stimulate, moderate ones paralyze, and large ones destroy tissue. But there has been a great deal of discussion as to whether the stimulation is a direct one due to the immediate action of small doses of rays or whether it is secondary and dependent therefore on a primary harmful effect of the rays. As a contribution to a solution of this question Dazzi has irradiated the splenic region in patients with malaria and tuberculosis and in ones convalescing from infectious diseases, and observed the changes in the number of red and white cells, the number of granular corpuscles and the Arneth leucocyte formula during the irradiation.

The object of his investigations was to determine:

1. Whether it was possible by irradiating the spleen with minimal doses by the technique of Pais to bring about changes in the blood picture which might be considered an index of a general reaction of the organism to stimulation by the rays.

2. What changes are produced in the circulating blood by irradiating the splenic region with small and moderate therapeutic doses and what significance can be attributed to these modifications from a clinical point of view.

He concluded that no changes are produced in the blood picture by the use of doses below the therapeutic dose while with small and moderate therapeutic doses there is:

1. An immediate and temporary hypoleucocytosis followed by a hyperleucocytosis, especially evident after the first irradiations, probably due to a temporary humoral disequilibrium caused by the cytolysis produced by the rays.

2. A constant, secondary progressive and durable hypoleucocytosis, the intensity of which varies with the size of the dose used. This is accompanied by signs of leucolysis.

3. A considerable increase in the number of granular cells and a moderate increase of erythrocytes which may be regarded very probably as due to a stimulation of the blood-forming organs secondary to the injurious action of the rays on the erythrocytes of the spleen. These changes in the blood picture may have a good effect on the disease under treatment and on the general condition of the organism.

The author believes that these changes are a sign, not of a stimulation of physiological processes, but of a stimulation of the blood-forming organs secondary to the destructive action of the rays.

De Nobele, and Lams. Action of the roentgen ray on the progress of pregnancy and the development of the fetus. *Bull. Acad. roy. de méd. Belg., Brux.*, 1925, 5. s., v, 66–82.

An erythema dose of the roentgen ray has a definite effect on pregnancy in the guinea pig and rat; in most cases it is interrupted by death of the fetus. This action is more pronounced if the rays are penetrating and death of the fetus is more certain if the irradiation has been given early. If the embryo is not killed early in pregnancy, their further development is abnormal and terminates in abmornal young. Abortion was not observed but evidences of the resorption of the fetus has been shown. Irradiation seems to favor the formation of ovarian cysts. The use of the roentgen ray in the treatment of fibromas of the uterus must depend upon whether or not the patient would be subject to the above effect of such treatment.

Emile-Weil P., and Lacassagne, Antoine. iv. Pernicious anemia and fatal myeloid leukemia caused by the manipulation of radioactive substances. *Bull. Acad. de. méd., Par.*, 1925, 3. s., xciii, 237–241.

A review of the literature is given in which many cases are reported showing certain ill effects of excessive application of radioactive substances on the blood-forming tissues. It is an established fact that this danger exists and must be considered in the use of all radioactive substances. A detailed case is reported of a man forty years old, a chemical engineer, whose general health was good, but who had worked for some time in scientific investigations on radioactive bodies, radium and also thorium for therapeutic purposes. Four years after close contact with these substances, the patient suffered from fatigue, digestive troubles, vomiting, diarrhea, loss of appetite, loss of color, bleeding gums, tendency to fainting, pulse 100, temperature 38° to 38.5° C., etc. On entering the hospital, the erythrocyte count was low, hemoglobin 25, leucocytes 4,600, hemorrhage difficult to stop, and coagulation time of blood long. Three blood transfusions were made without apparent benefit. A detailed record of the blood counts later are recorded. The patient died about two months after entering the hospital. Another case is reported which is quite similar, the patient having been a worker in radioactive substances, especially thorium. The history of the progress of his condition was somewhat similar to that reported above, and the patient died with the same symptoms. The blood in the heart did not coagulate, and putrefaction was rapid. The spleen and liver were enlarged, but the lungs were normal. One of these died of pernicious anemia, and the other of myeloid leucemia caused by the effect of the radioactive substances, with which both worked, on the blood-forming organs.

Jolly, J. The manner in which roentgen rays act on tissues. The radiosensibility may be modified experimentally. *Bull. Acad. de méd., Par.*, 1925, 3. s., xciii, 276–279.

It has been thought by many authors that lesions produced by the roentgen ray on tissues were caused by the toxic effect of the choline formed from the decomposition of lecithin; in other words, an intoxication of the tissues with choline. Certain cells are also destroyed by the

direct action of the rays, e.g., eggs, protozoa, bacteria, etc. The nature of the direct action on the cells is the subject of the present paper. It is shown that dead cells do not show characteristic lesions after irradiation for as long as two hours, while living cells of the same organ are materially affected by the same intensity of rays of the same duration. It is necessary that cells be physiologically functioning when the roentgen ray is applied if lesions are to be produced. Reducing the vitality of certain cells seems to protect instead of to cause an increased sensibility. Dry seeds are not sensitive to the rays, whereas germinating seeds are quite so. Radiosensibility of cells, then, depends upon the physiological condition of the cell at the time of irradiation. Retarding the life processes of cells causes them to become less radiosensitive; increasing these life processes causes them to become more sensitive to irradiation.

MILANI, EUGENIO. Radiological study of peristalsis and the so-called "autonomous movement of the mucosa" of the jejunum. *Radiol. med.*, July, 1924, xi, 449–455.

In Radiologia medica for 1923 Milani published a study of the peristalsis of the jejunum made by means of a series of roentgenograms taken at short intervals. He found: (1) a transportation peristalsis which shows a progressive movement of the barium from loop to loop which is sometimes very rapid; (2) a characteristic "little peristalsis" which is a movement of kneading and mixing. A rapid series of roentgenograms shows that the contents of the intestine is divided and redivided into a series of lumps by a movement of the circular and longitudinal fibers of the muscular coat; (3) the loop does not remain motionless during this kneading peristalsis but undergoes a pendulum movement; (4) during the intervals of peristalsis slight superficial mixing movements may be seen, probably caused by contractions of the longitudinal fibers.

In the present article the author has again taken up a study of peristalsis with the aid of a rapid series of roentgenograms taken at intervals of 4–6 seconds, considering particularly the autonomous movements of the folds of the mucous membrane and the variability in the picture of the jejunum, which sometimes looks like a band, sometimes like crystals of frost or flakes of snow or pine branches covered with snow, and varies not only in different individuals but in the same individual in different loops. This variability in the picture depends on the folds in the mucous membrane and on the valvulae conniventes which in turn depend on peristalsis and the degree of tonicity of the loop. The nature of the contrast meal, the emptying time of the stomach and the time the roentgenogram is taken are of secondary importance. The formation of these folds may be regarded as passive or as due to an active function of the muscularis mucosae itself. The latter view is adopted by Forssell in an article in the American Journal of Roentgenology, Feb., 1923, but he applies this hypothesis to all the mucous membrane of the digestive tract from the stomach to the colon.

From a study of a number of roentgenograms, which are reproduced, the author concludes that the variable folds in the mucous membrane constitute a "little peristalsis" of the digestive chamber, not by passive filling but by active movements and that these movements of the muscularis mucosae are antagonistic to the contraction of the muscularis propria.

LAPENNA, MARINO. Peristalsis of the last part of the small intestine (ileum) studied by means of series of roentgenograms. *Radiol. med.*, September, 1924, xi, 574–580.

Milani has recently shown by a series of roentgenograms that all the old ideas in regard to the peristalsis of the small intestine must be revised and that the different segments must be studied separately. The author has studied the ileum in the same way and finds that the peristalsis of the ileum is intermittent and that the interval when there is no peristalsis may, under certain conditions of tonus and in the lower loops, be as long as an hour. During this interval in peristalsis the loop as a whole undergoes a movement of oscillation which may favor the descent of its contents.

Peristalsis, properly speaking, of the ileum consists of two movements, one a movement of segmentation which serves for mixing and kneading of the contents, and a progressive movement during which absorption is accomplished. This movement is always made in the same way; it is a sort of serpentine movement in which a small mass, the head, is first detached, followed by the rest, the tail. Sometimes, but rarely, a whole segment of the loop empties at once.

Milani in his work described slight superficial mixing movements due to the longitudinal fibers. The folds of the mucous membrane are necessarily harder to study in the ileum because of the permanent distention of this part of the intestine, and the author gives a quite different interpretation to some of the pictures from that of Forssell. At any rate there is evidently a close relationship between the folds and the tonus of the mucosa and the contractions of the muscularis propria, but this relationship requires further study.

MERKLEN, WOLF, AND NEEL. II. Myeloid leucemia in a woman previously irradiated. *Bull. Acad. de mêd., Par.*, 1925, 3. s., xciii, 364–367.

A case of myeloid leucemia is reported in which the patient, with no significant antecedents except prolonged irradiation for fibromyoma of the uterus, died four years after treatment with the roentgen ray. At the age of fifty-four the patient was subjected to intensive and prolonged roentgenotherapy, the treatment lasting for seven hours, the body being protected with a sheet of lead, the irradiation being confined, presumably, only to the fibromyoma of the uterus. On the following day and the day after the patient suffered severe malaise, extreme weakness, continuous vomiting, violent headache and definite abdominal pains. When the patient came to the attention of the authors four years afterwards she was extremely pale, and had slight exophthalmos. On examination, enlargement of the spleen and liver were very easily noticeable. A detailed description of the blood count, etc. is given; the leucocyte count was high and the erythrocyte count low, and there was a great increase in myeloblasts. The authors cannot say with certainty, but they are very much of the opinion that the intense and prolonged irradiation with the roentgen ray was responsible for the myeloid leucemia, from which the patient died. It is the only antecedent which offers any explanation of the condition.

STEWART, STEELE F. Frontal fractures of the patella. *Ann. Surg., Phila.*, February, 1925, lxxxi, 536–539.

Frontal fractures of the patella are exceedingly rare in the literature and the detection of this condition offers some difficulty. A roentgen examination should be secured in all cases, although different methods for this examination may be necessary. In cases where only the articular cartilage has been sheared off, either in whole or in part, an ordinary roentgenogram might be inconclusive or even misleading. The aspiration of the joint followed by an injection of air, carbon dioxide or oxygen might throw the offending part into relief. The following mechanism is suggested as being responsible in certain cases: A partial or complete dislocation of the patella occurred without rupture of its lateral ligaments. The knee-cap became caught and the powerful contraction chiefly of the vastus medialis caused a shearing off of a portion of the patella in the frontal plane. The condition is considered a fracture occurring in adult life and more frequent in the female, probably because of the greater frequency of knock-knees among women and their greater liability to recurrent dislocation of the patella. It is associated with severe muscular action rather than with direct trauma.

Two cases found in the literature are recited, and an additional case observed by the author is briefly described. This occurred in a woman aged forty-eight during the wreck of her motor car. The roentgen examination showed a frontal fracture of the patella in good approximation. The recovery in all cases was good. There was a return of normal function, or practically normal function, within a period of one to two months.

STILES, PORTER. Foreign bodies in the air and food passages: observations on twenty-five cases. *South. M. J.*, May, 1925, xviii, 376–379.

Every case giving a history or presenting symptoms suggestive of the possible presence of a foreign body should be subjected to a complete diagnostic study before being considered negative. It should never be taken for granted that a foreign body has been or will be passed or expelled. Pain is not a constant symptom even of sharp foriegn bodies, and its absence is of no diagnostic significance. The asthmatic wheeze is one of the most constant and reliable signs of foreign body in the respiratory tract, and its presence should always be carefully noted in an examination and inquired for in taking history.

The roentgen ray in the hands of an experienced and skillful roentgenologist is a most valuable diagnostic aid in all varieties of foreign bodies. Plates should also be taken after removal of the foreign body and included in the record of the case. Foreign bodies loose in the trachea are especially dangerous, because of their liability to impaction against the vocal cords and the frequency with which they produce subglottic edema. They should be removed promptly.

Foreign body removal should be attempted only by well practiced endoscopy, and with an adequate instrumentarium. The use of blind and haphazard methods is entirely unjustified. The removal of the foreign body does not terminate the case. All patients should be watched carefully until fully restored to health.

In the 25 cases under discussion the foreign body was lodged in the esophagus in 8 and in the respiratory tract in 17. Four cases occurred in adults, the remainder being in young children aged one to ten, the most common age being between one and three. All of the cases were of short duration; in the longest, the foreign body having been *in situ* twenty-six days.

SWAN, THEODORE S. Fibromyxoma of the stomach projecting into the duodenum. *Radiology*, May, 1925, iv, 430–431.

A case is reported in a man, aged forty-five, who presented himself complaining of pain and tenderness in the precordial area of three weeks' duration. The character of the patient's symptoms did not suggest a gastric lesion. This was only revealed by roentgen-ray examination, which was made as a matter of routine. The roentgenogram disclosed a peculiar deformity of the duodenal cap, probably due to a benign tumor; and on this basis an exploratory operation was advised. The other supportive data were a secondary anemia, achlorhydria, and occult blood in the stools. At operation, there was discovered a pedunculated gastric tumor attached to the upper wall and extending 7.5 cm. into the duodenum. The pathologist's diagnosis was: single ulcerated fibromyxomatous polyp (8 cm. long and 2 cm. in diameter.)

THOMSON, J. W. Diverticulum of the pharynx. *Lancet, Lond.*, May 23, 1925, i, 1078.

These diverticula may possibly be of congential origin although they have not so far been discovered in infancy or childhood. Some cases are ascribed to injury of the esophagus; others to stenosis of the first part of the esophagus; or the cause may be extrinsic, as by pressure from a tumor. They occur mostly in adult males and symptoms appear rarely before forty. The sac passes generally to the left, sometimes to the right, of the esophagus and may reach the mediastinum.

A case is reported occurring in a woman aged sixty-three, who had suffered for fifteen years with difficulty in swallowing. The roentgen-ray examination showed the barium meal filling the pouch and then overflowing into the esophagus. The diverticulum was not palpable. The condition of the patient was so acute that a gastrostomy under local anesthesia was first performed. After a suitable recovery from this it was considered fit, five weeks later, to remove the diverticulum. The patient made an uneventful recovery.

TOVELL, H. M. *X*-ray findings in primary carcinoma of the lung. *Canad. M. Ass. J.*, May, 1925, xv, 485–489.

The roentgenologist is confronted by many problems just as complicated as those of the clinician. He is supposed not only to differentiate between types of pulmonary carcinoma but also between masses of carcinomatous origin and masses arising from other malignancies, benign growths or inflammatory processes. One may be surprised sometimes to see the comparative smallness of lung tumor in comparison with changes exhibited on the roentgen film. This is due to the fact that the primary growth is rarely uncomplicated. Secondary inflammatory processes have an excellent medium in which to develop and they may occur at any stage. Clinically it often happens that the secondary inflammations are not only the immediate cause of the patients seeking medical advice but so dominate the clinical course that growth is not suspected. Roentgenographically these changes are shown as bronchopneumonic or pneumonic areas, and in a tumor of bronchial origin the early occlusion of a bronchus renders the resulting collapsed lung prone to secondary infection and abscess. These various processes are all capable of casting shadows of a density equal to that of a tumor and may be so intermingled that the original tumor is completely masked. Once fluid is present in the thorax it renders the roentgen interpretation difficult, if not impossible. In some cases, particularly in the infiltrating variety, the growth may extend through the lung and along the pleura giving rise to marked pleural thickening which roentgenologically will act as fluid. In such cases an induced pneumothorax may fail to be of aid.

The object of this paper is to serve as a basis of understanding for the clinician and pathologist so that they may realize the problems of the roentgenologist. No field offers more interesting diagnostic problems than primary lung carcinoma but the solution of any case can be reached only by the cooperation of the clinician, pathologist and roentgenologist.

VAN DER HOEVE, J. Roentgenography of the optic foramen in tumors and diseases of the optic nerve. *Am. J. Ophth.*, February, 1925, vii, 101–112.

Recent literature has called attention to the particular importance of tumors of the optic nerve. Important information may be gained in these cases from roentgenograms showing the size of the optic foramen. Roentgenography of the optic foramen can be used also for the examination of fissures, fractures and callus conditions. For this purpose it is absolutely necessary to know exactly the condition of the normal optic foramen in the roentgenogram. This can be done by roentgenographic study in the cadaver and in normal persons. A good image of the optic foramen is obtained in the roentgenogram of the ethmoid taken according to Rhese's method. Experience shows that a normal optic foramen does not vary greatly in size within narrow physiological limits. The diameter of the optic canal was found to be from 4 to 6.5 mm,. and in shape usually circular, sometimes oval.

A case of neurofibromatosis causing enlargement of the foramen and great narrowing of one field of vision and loss of the other is reported. Operation enlarging the foramen of the better eye was followed by considerable recovery of the field of vision. A case is also reported of endothelioma arising from the sheaths of the optic nerve. Here the foramen was not enlarged. Removal of the orbital tumor was followed by no evidence of recurrence. Great care should be taken to avoid mistakes as to the real size of the opening and the form of the optic canal.

WHITAKER, LESTER R., MILLIKEN, GIBBS, and VOGT, EDWARD C. The oral administration of sodium tetraiodophenolphthalein for cholecystography. *Surg., Gynec. & Obst.*, June, 1925, xl, 847–951.

The oral administration of tetraiodophenolphthalein for cholecystography is used by the authors in the form of pills coated with salol in syrup of tolu or in pills coated with stearic acid. The advantages of the oral method are that it relieves many patients of the hospitalization necessary for the intravenous method and that it causes them very little inconvenience and few unpleasant symptoms. Cholecystograms have been produced in 93 per cent of normal subjects by the oral method; and this method is advised as a first procedure in cases suspected of gall-bladder disease, to be followed by the intravenous method in those instances where the results with the former are not conclusive.

On the whole, the shadows produced by the oral method were less dense than those by the intravenous method with the tetraiodo salt, although there were numerous exceptions to this rule. Because the shadows are somewhat faint the roentgenographic technique must be exceptionally good and particular pains must be taken to eliminate respiratory movements. The dose of tetraiodophenolphthalein is equivalent to 0.08 gm. per kilo of body weight (from 3.5 to 6.5 gm.). This is issued in the form of 5 gm. salol-coated pills. The results as obtained first on human volunteers and then on 12 subjects and 50 patients showed effects much less noticeable than was the case after intravenous administration of the salt. One should guard against an overdose of salol from the pill coatings.

WILLIAMS, EVERARD, and REYNOLDS, RUSSELL. A method of determining the patency of the Fallopian tubes by *x*-rays. *Brit. M. J.*, April 11, 1925, 691–692.

The investigation of certain cases of sterility involves an examination of the Fallopian tubes in order to ascertain whether they are patent. A desirable method for establishing this should be one that does not depend upon creating a positive intrauterine or intratubal pressure, which is dangerous. It was discovered that by means of a simple syringe and cannula, barium or bismuth emulsion may be introduced into the uterine cavity (without pressure) and that this opaque material travels up to the distal portions of the tube and the fimbriated extremities where the Fallopian tubes are patent. An anesthetic is not necessary for this technique.

Experiments show that the particles do not find their way up the Fallopian tubes unless there is free communication between the tube and the peritoneal cavity. This suggests that a purely mechanical factor such as aspiration is probably responsible for the travel of the opaque material rather than ciliary activity. If the tubal ostia are patent the emulsion travels from the uterus to the tube and therefore if the shadow is seen in the tube at all it indicates patency of that tube. In the course of 72 hours the whole of the bismuth or barium has disappeared apparently without after-effects upon the patient. The shadow in the body of the uterus gives a much more accurate estimation of the size of the uterine cavity in cases of infantile uterus or other maldevelopment than does bimanual examination. It is believed that the demonstration of the passage of the particles from the uterine cavity to the fimbriated extremity of the Fallopian tube throws some light on the origin of ascending infections of the genital tract and perhaps also on that of endometrioma of the ovary and the deposit of fragments of exfoliating endometrium in the pelvic peritoneum and on the surface of the ovary.

WILSON, W. FRANK. Oesophagoscopy: A means of detecting foreign bodies non-opaque to *x*-rays. *Brit. M. J.*, April 4, 1925, 656–657.

The fishbone is one of the commonest of the various foreign bodies becoming lodged or impacted in the human gullet. In such cases the formation obtained form the roentgenoscopic examination or from a roentgenogram is generally unsatisfactory and may be misleading. The bismuth pastille and attempts to get barium paste to adhere to the foreign body usually fail. A simple method is given for assisting in the location of the foreign body.

Small pieces of cotton wool are lightly teased out to the size of a shilling or slightly larger, and soaked in barium paste. Six or eight of these are given to the patient to swallow, one at a time. A minute or so afterward a table-

spoonful or more of barium paste is swallowed. Two or three minutes are then allowed to pass to permit surplus barium to leave the gullet, which is then roentgenographed. The shadow of the wool mass held up around the foreign body has the appearance of a cone with the apex downward. On passing the esophagoscope the lustrous white reflection from the upper part of the bariumized wool immediately arrests the eye.

In all of the cases in which this method has been employed so far the site of impaction of the fishbone was the upper part of the gullet. Contraindication to the use of this method would be any degree of dyspnea in association with a foreign body suggesting involvement of the larynx.

PODESTA, VITTORIO. Experimental study of intestinal lesions from roentgen rays in intense deep roentgen therapy. *Radiol. med.*, April, 1925, xii, 201–216.

In the beginning of radiotherapy superficial lesions were observed but lesions of internal organs were not noticed until after deep roentgen therapy was begun. The author reviews the intestinal lesions that have been reported in human beings and reports his own experimental work on dogs. He used a somewhat different technique from the American authors who have reported similar experiments. They opened the abdomen and exposed the intestines and irradiated without filtration, while he irradiated through the abdominal wall and used filters, as this method corresponds more nearly to ordinary therapeutic practice. He experimented on large dogs which were in perfect health, and in some of them used light filters, while in others he used the filter which is ordinarily employed in practice, that is, 0.5 mm. zinc and 2 mm. aluminum. He found that the erythema dose for the dog is considerably larger than for man. The animals that were not killed by the irradiations were kept alive for three months and a half and then killed by puncture of the 4th ventricle. The ones that had been given a complete human erythema dose over several fields died in from three to five days; in the meantime they had not taken any food and presented severe diarrhea and serious prostration. On autopsy they showed no signs except an intense hyperemia, particularly of the small intestine. The others which were given smaller doses lived for three and a half months. When they were given an erythema dose over a single field there were marked intestinal lesions; when they were given a suberythema dose over several fields the lesions were not any worse, even though the total dose may have been as much as three times as large. These animals refused food for the first few days; then quite a pronounced skin erythema developed with depilation and desquamation of the skin, sometimes even to the extent of true ulceration. The lesions found on autopsy were chiefly in the mucous membrane of the small intestine. They varied from slight degrees of small cell infiltration and change in the nuclear chromatin to total disappearance of the mucous membrane in cases of ulceration. The ulcers were about 2 cm. in diameter, ellipsoid in form and their longest diameter ran around the intestine. In the cases where there was no ulceration the lesions were chiefly in the basal part of the mucous membrane; no visible changes were found in the muscularis mucosae. Macroscopically there was only moderate hyperemia with partial stenosis of some parts of the intestine. Microscopically the circular layer was most involved and the changes consisted chiefly of small cell infiltration and alterations in the nuclei. No lesions of the serosa were seen.

The author believes that in the human subject intestinal disturbances caused by the rays are often attributed to the disease from which the patient is suffering. Unless they are intense in degree they disappear spontaneously. Free mobility of the intestine tends to prevent lesions and adhesions to favor them and therefore he prefers the French method of small doses over considerable intervals to the German method of giving one very large dose. He also advises putting the patient in the Trendelenburg position in irradiating the uterus. Further studies should be made on animals to determine the intervals at which application of rays can be repeated without damage to the intestines.

PIERGROSSI, LAMBERTO. High tension or high intensity in roentgenography? *Radiol. med.*, December, 1924, xi, 752–757.

Makers of tubes have increased the yield up to 80, 100 and 120 ma., taking great pride in this accomplishment without considering whether or not it was necessary or useful. The author concludes that it is not and that the ordinary street current is not sufficient for producing such a yield. Mascherpa at the Congress in Berlin in April, 1924, reported a tube which yielded 250 ma. without fall of tension. The author seems disposed to doubt the correctness of this assertion and says that at any rate it is not necessary as he obtained excellent pictures of the stomach with a modest Radiagna apparatus in $\frac{1}{10}$ second with 60 kv., 40 ma. and a Phoenix tube at 60 cm. distance. The potential of the current falls with the increased intensity in the tube and in

this case if the intensity had been increased to 60 ma. the tension would have fallen so that the $\frac{1}{10}$ second would not have sufficed for a roentgenogram of the stomach. To get shorter times of exposure it is necessary not so much to increase intensity as to increase tension.

He also discusses the question whether pictures richer in detail can be obtained with soft rays and comes to the conclusion that wherever it is necessary to have almost instantaneous pictures ($\frac{1}{5}$ to $\frac{1}{10}$ second), that is in roentgenograms of the stomach and intestines, pregnancy, the heart, thorax and in general in organs subject to spontaneous movement it is necessary not so much to make use of great intensities, which are possible with present day apparatus only with the use of soft rays, as to make use of hard rays with a distance of from 15 to 20 cm. and an intensity of 15 to 20 ma.

RICITELLI, L., and BELLUCCI, B. Contribution to the clinical and roentgen study and medical treatment of large nontuberculous cavities. *Radiol. med.*, November, 1924, xi, 699–703.

The patient was a young woman, aged eighteen, who had a massive pneumonia. This was followed by an abscess which left a cavity the size of an ostrich egg occupying almost all of the middle and lower lobes of the right lung. The points which distinguish the roentgen picture of tuberculous cavity from that of abscess cavity are the rounded shape of the former and its clear outline which is lacking in the latter because in general it is formed by the confluence of multiple abscesses. However, differentiation by roentgen examination alone is sometimes impossible and the history and clinical examination must be considered also. Surgery is not always necessary in such cases and in this case complete cure was brought about by neosalvarsan treatment. This seems to stimulate the defensive forces of the body and act on the patient's septicemic condition.

ROCCAVILLA, ANDREA. Roentgenogonometry of the heart and large vessels. *Radiol. med.*, December, 1924, xi, 729–751.

Very little work has been done in clinical roentgenology in the study and practical application of the intrinsic and extrinsic angles of the heart and great vessels. Roccavilla has studied them with a view to establishing a series of rules that can be applied both in clinical work and in pathological physiology. He proposes a roentgenological technique which is very simple and entirely within the limits of possibility as it is based on principles that have long been known. By means of this technique he has established a rational system of measurements of the angles which he divides into three groups:

(*a*) Extrinsic angles or angles of orientation in space which are measured with relation to a horizontal plane which is taken as the base of the system. This group includes the angles of inclination of the heart and the great vessels at its base, and of the axes and planes of each of the parts of which they are made up:

(*b*) intrinsic angles or measures of the angular relations between the different parts or segments of the heart or of the aorta, that is the cardio-cardiac and aorto-aortic angles;

(*c*) reciprocal angles or the mutual goniometric inclination between the heart or a given segment of the heart and one or another of the large vessels at its base, especially the aorta, the angio-cardiac or cardio-aortic angles.

All of these angles are described in detail in the text and illustrations of them given. The author has endeavored to establish an average goniometric type, taking as a subject a male individual thirty-five years of age, with a perfectly harmonious physical constitution, whom he studied while he was standing upright, with quiet breathing and stomach empty. Using this type as an average he studied the variations produced in the angles by differences in physiological conditions such as the age, sex and position of the subject, respiration, fatigue, degree of fullness of the stomach, pregnancy, etc. Tables are given showing the physiological variations in the different angles.

ROCCHI, GIUSEPPE. Roentgenography with hard tubes. *Radiol. med.*, October, 1924, xi, 616.

At the recent radiological congress at Berlin Prof. Gortan of Trieste discussed his work in very rapid roentgenography in a small fraction of a second in which he used hard tubes with a spark gap of 22–23 cm. He showed roentgenograms of the stomach, thorax, bones, etc. Rocchi examined some of these roentgenograms of the thorax and found that, aside from the fact that they were a little grey, they gave marked contrast and could be read very well. He believes that one difficulty in the use of Gortan's hard tubes is the insufficient street current available. There are now forms of apparatus which yield 150 to 250 ma., but for this it is necessary to have 150 to 200 ma. with 110 volts at the source and there are few radiological institutes that have such a current available. Different roentgenologists use different technique with excellent results. A great deal depends on the operator knowing his tube well and working with the

utmost exactness. Antidiffusors are bound to become an indispensable part of roentgen equipment. There are three types, the Ziegler with radiating lead plates, the Akerlund type with spiral plates and the Bucky-Potter type with parallel plates. The latter type is well known in Italy and it is to be hoped that with its use combined with the use of very hard tubes and very brief exposure it will be possible to obtain good roentgenograms of the stomach, lungs, intestines and heart.

SCHWEIZER, E. Specific roentgen injury of the heart muscle. *Strahlentherapie*, 1924, xviii, 812–828.

The human heart has been regarded as practically insensitive to roentgen rays. This, however, is not always the case, as is proven by the observations of Rössle on the alteration in myocardial fibres following intensive irradiation of a mediastinal tumor. This particular case, occurring in a woman aged thirty, is described in detail. The case came to autopsy and was described as Hodgkin's disease, followed by exudative pleuritis. The mediastinal tumor was strictly localized, and was not associated with a status thymicolymphaticus. As is sometimes the case after effective roentgen irradiation, the specific nature of this tumor could not be determined because it was found macroscopically and microscopically to consist of homogeneous sclerotic hyalin connective tissue. However, the effects of the roentgen rays extended beyond the tumor to the surrounding normal tissues, causing extensive scar formation. The heart and the large vessels of the thorax suffered particularly. The changes in the pleura, lung and superior vena cava should have produced a very considerable increased load upon the whole circulation, and there should have been a decided hypertrophy of the heart. This was, however, not the case in this patient. The heart was small and the muscle dark brown and slack. Despite the fact that this muscle did increased work for more than a year there was no sign of thickening of of the wall, especially of the right heart. The heart was immediately adjacent to the tumor and the evidence seems clear that the roentgen rays produced a direct effect upon both structures. The peculiar nature of the changes produced in the muscle fibres were observed in the microscopic examination. These observations are given in full detail, with illustrations.

The significant findings were observed especially in the right ventricle; in other portions of the heart there was an occasional fine-fibred alteration, but never a globular breakdown and emptying. The specific roentgen injury of the muscle was found to consist of a swelling and central globular degeneration of the fibre, sometimes with unaltered fragments of the fibre substance contained within the sarcolemma. Some of the globules were observed free in the muscle as the result of rupture of the membrane. There was an increase of nuclei in the portion of the fibril remaining undegenerated. The microscopic picture also disclosed atrophic muscle fibres, with nuclear multiplication and rows of small prismatic columns, due to degenerated muscle fibres; longitudinal fibrillar degeneration of the muscle fibre with nuclear increase; degeneration of the myoplasm into small prismatic globules and a delicate net of fibres; and finally, degeneration of the interstitial connective tissue.

The specific degenerative process in muscle fibres affected by roentgen rays may be put under two categories: (1) The breakdown of the myoplasm within the muscle fibre, and (2) the ejection of myoplastic globules (termed by the author "plasmoptysis") and the destruction of the sarcolemma. Both of these processes are often seen together in the same fibre. This is important because it proves that the final stages of degeneration actually originate within the muscle fibre. They are nothing else but the residue of the cell membranes after loss of the myoplasm, and are not due to changes in the connective tissue or the blood vessels.

A consideration of these observations and those reported in the literature about the effects of roentgen rays upon muscle fibre as well as upon the developmental processes of muscle tissue, leads to the conclusion that there exists a definite and specific form of degeneration of muscle fibres as the result of roentgen-ray injury. There appear, on the one hand, the usual degenerations of the fibres in the form of fatty degeneration, vacuolar aggregation and granular breakdown such as are observed in the most diverse lesions, due to infections and toxic agents. Along with these, there occur the peculiar changes described above, *i.e.*, swelling of the sarcolemma, globular breakdown of the myoplasm followed by emptying (or plasmoptysis) of the contents, destruction of the sarcolemma, pronounced nuclear multiplication together with a peculiar form of myoplasmic change into prismatic globules strongly resembling embryonal developmental formations.

STERZEL, K. A. Is it possible to secure dosage for deep therapy with mechanical high tension rectifiers? *Strahlentherapie*, 1924, xviii, 806–809.

Küstner, in his work on the standardization of roentgen measurements pointed out the advantages for purposes of deep therapy of

the hot filament electron tube over the mechanical rectifier with rotating spark gap. These conclusions were based upon very careful measurements made upon the particular apparatus used. It is, however, quite possible to construct mechanical high tension rectifiers that overcome, to a large extent, the obvious imperfections in apparatus. The "radio-transverter" has been found by the author to yield, under usual conditions of operation, the satisfactory results which have been hitherto absent from mechanical rectifiers. The machine has been modified so as to yield a minimum of loss in voltage and energy across the spark gaps —losses which fall within the limits of accuracy in reading the recording instruments.

The problem of the constancy of dosage in continued operation has been considered. It was found that the variations in surface intensity remained constant during a period of seventy-nine days of continued intensive operation without the least effect upon the brushes. The customary limits permissible in good therapeutic practice were uniformly maintained. It is pointed out that under the circumstances the condition of the roentgen tube and the maintenance of voltage were more important than the spark gaps as determining factors. Spectrograms are exhibited to demonstrate that the "radio-transverter," when fitted out with suitable high tension condensers, may be made to function efficiently under "stabilized" potential in actual practice.

It is concluded that the objection originally raised to mechanical rectifiers is not universally applicable.

VAJANO, DOMENICO. A peculiar action of ultraviolet rays studied in relation to analogous properties of roentgen rays and its utilization in dermatology. *Radiol. med.*, October, 1924, xi, 609–616.

There is a considerable degree of parallelism between the biochemical effects of roentgen rays and those of ultraviolet rays based on the fact that both these kinds of rays are subject to the same physical biological laws. Both ultraviolet rays and roentgen rays have a sedative action on itching of the skin. Experience thus far has shown definitely that this action is sure to be exercised on Hebra's pruritus, in certain chronic eczemas and in recurrent herpes. The action of ultraviolet rays is slighter and less durable than that of roentgen rays.

Cases are described showing that in Hebra's pruritus the therapeutic effects vary, depending on the dose used and the reactive capacity of the skin. Irradiation with small doses has a very good effect on the itching, either abolishing it completely or ameliorating it greatly. But this purely symptomatic action is transitory, that is, it lasts little if at all after the application of the rays is stopped. To definitely cure the pruritus it is necessary to overcome the macroscopic lesions which cause it. This can be done by using very strong doses, strong enough to bring about an intense erythema which is followed by desquamation of certain parts of the affected skin.

But it is not always easy to bring about this curvative erythema for in general the skin of patients with pruritus is not very radiosensitive and in certain cases (those of patients with very dark skins) reacts only to doses so large that they cannot be given without causing general derangement, such as headache, dizziness, anorexia and fever. In the second of the 3 cases described it was impossible to bring about a sufficient cutaneous reaction without injuring the general health. But in the 2 other cases in which the reactive capacity of the skin was good complete cure was attained.

In the forms of circumscribed chronic eczema with lichenification and very severe pruritus ultraviolet irradiation is effective. Generally a small number of treatments with a Kromayer lamp at a distance of 10 to 20 cm. with a filtration of 3 mm., each treatment lasting from 5 to 20 minutes suffice to make the infiltration disappear permanently and to cure the pruritus, sometimes even in cases where roentgen therapy has failed.

In a preceding article the author described a group of cases of recurrent herpes of the hands in which ultraviolet rays brought about complete cure in 3 to 10 treatments. There has been no recurrence. These cases were treated six to thirteen months ago.